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Notes on Mesabi Range Mining Practice--I.

By L. O. Kellogg*

SYNOPSIS--Mining practice excellent, as a whole; conditions not altogether favorable; two well known mining methods developed here. Seven mining methods, all told, may be distinguished. Openpit work varies in track layout and in equipment. Types and makes of steam shovels compared. The milling method as followed at the Albany mine. Exploration and development well systematized. The two methods of top-slicing both give high extractions.

Except it be the Rand, no metal-mining district in the world is comparable with the Mesabi in the vast scale of its operations. In annual tonnage and in total value of the metal content in a year's production, it is pre-eminent. The close network of railroad tracks, the thickly crowded cities and towns, the haze of smoke from the great pits, the steady streams of ore trains over three roads, and perhaps most striking of all, the huge stripping dumps looming like mesas on every side, these impress forcibly on the imagination of the visitor the magnitude of the mining work here carried on.

White Iron Lake Mine. A Small Property Stripped but Mined by Hand with Skip Hoisting

Stripping around Edge of Deep Susquehanna Pit, on the Edge of the Village of Hibbing

Albany Mine. Mill Holes down Center. Stripping Dump in Background

Mining Interesting, Varied and of High Class

One comes to the Mesabi with the belief that everything will be found cut and dried, the deposits all alike, the problems long ago solved, all operations standardized and any one mine the perfect duplicate of its fellows in the same class. One departs knowing that countless problems still arise, that infinite variety exists and that new methods in detail at least are likely to be forthcoming for a long time yet. While in its broad outlines the mining is standardized, and excellently so, and while the various deposits compared with most metal-mining districts are much alike, there are variations in situation, dimensions, grade, shape, etc., capable of forming so many combinations as to put each orebody in a distinct class requiring careful study, not only to determine the choice among existing methods of handling, but to devise new methods of attack.

At first also to the visitor, the mining seems easy. The ores are accessible, soft and of high grade. What more could one ask? But even a high-grade iron ore is low grade compared with ores in general; while it lies near the surface, it must all be raised in some way or other, since in this flat country there is no chance for tunneling; soft ores, furthermore, are not always cheap to mine; and finally in many mines heavy water makes trouble in a variety of ways. The situation confronting the Mesabi miner was unique; he attacked his problem boldly, experimented along intelligent lines and arrived at a most satisfactory solution, involving the use of two mining methods, the top-slicing and the steam-shovel, distinctive of the range and bringing it a fame second only to that of its great tonnage and richness.

The occurrence and origin of the Mesabi ore have been the subject of much geological investigation. The latest

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word on the subject can be found in U. S. Geol. Surv. Monograph LII. The methods of mining have also been pretty thoroughly covered. The reader is referred to past pages of the JOURNAL, notably a series of articles by L. D. Davenport, "Caving System in Chisholm District," Sept. 7, 14 and 21, 1913; to a paper by Messrs. Bayliss, M'Neil and Lutes, presented at the meeting of the Lake Superior Mining Institute, August, 1913; and to Bull. No. 1 of the Minnesota School of Mines Experiment Station by Prof. Charles E. van Barneveld. It is not the purpose of this article to encroach on ground already well covered. Certain points of practice, however, are worthy of special mention and emphasis.

THE GENERAL METHODS OF MINING

The three generally recognized systems of mining followed are the steam shovel, the milling and the top-slicing. As the result of combinations of these and of internal variations, seven methods, all told, may be distinguished, although some of these are extremely unimportant. In the first place the deposit may be stripped of its overburden and mined with a steam shovel, hauling out the ore in standard cars with a locomotive; second, it may be stripped and milled in the old-fashioned way; third, it may be stripped, the ore mined with a steam shovel, hauled to a chute, dumped and raised through a shaft; fourth, it may be mined underground by the top-slicing method, using drift sets; and fifth, it may be so mined using square sets. All these methods are in common use. In the sixth method, the ore around the edges of a pit may be mined by slicing, trammed out and loaded into cars in the pit, to be hauled out by locomotives; in the seventh, followed in at least one instance, the ore is mined by hand in an openpit, hand trammed to an incline up one side of the pit and hoisted in a skip.

Several of these methods may be followed in the same mine at the same time. Thus in the Leonard, near Chisholm, three steam shovels are mining, hoisting is going on through the shaft and a good deal of ore is being trammed from underground and dumped from short trestles into railroad cars spotted in the pit. At the Alpena near Virginia, milling, steam shoveling and underground methods are followed simultaneously. And the number of mines using both steam shovel and underground methods is extremely large. The reason for this lies in the fact that the property being mined may contain more than one orebody, which may not be available for handling by the same method. Or one orebody may have more overburden on one side than on the other or it may get thinner on one side, in either case forcing the use of underground methods on that side, while the other may be steam shoveled. Furthermore, it is evident that practically no mine can be finished as an openpit. The track grades are almost sure to be largely ore in place and to remove this means abandoning the tracks and resorting to hoisting methods of some kind. Finally, as a deposit is mined deeper and deeper, increasing track grades must put an end to openpit mining; in such cases the milling system is the logical successor. The Genoa, near Gilbert, is a mine just changing over from the openpit method. Here a steam shovel will continue to load into cars, which will be hauled by a locomotive and dumped into a chute over the inclined shaft whence the ore will be hoisted in skips.

Openpit mining on a great scale probably reaches its highest development on the Mesabi. Even the openpits show a great variety of practice; the track arrangement and the choice of equipment are both susceptible of variation. In general, when a pit has been stripped and mining begins, it is considered desirable to avoid the use of switchbacks and develop the track system somewhat as a spiral, although this is not always possible or advisable. The openpit engineer has to overcome a great difference of elevation in extremely cramped quarters and must husband his horizontal distance carefully. The switchback tail track represents so much horizontal distance wasted, not helping at all to gain elevation. The switchback also slows up the traffic, from the necessity of stopping and reversing direction. On the other hand, however, sharp curvatures must be avoided. In general, the larger properties are able to get out with easier grades and curves than the smaller ones and can more easily

STEAM SHOVEL LOADING ROCK FROM THE BOTTOM OF THE GENOA PIT. THE DIPPER IS FILLED BY HAND

avoid switchbacks. The Utica, for instance, which is small and extremely narrow, has little or no curvature in its track system, the track climbing one side of the pit in a series of switchbacks. On the other hand, at one small pit, the Commodore, there are now no switchbacks whatever and the grades and curves are not prohibitive.

OPENPIT MINING

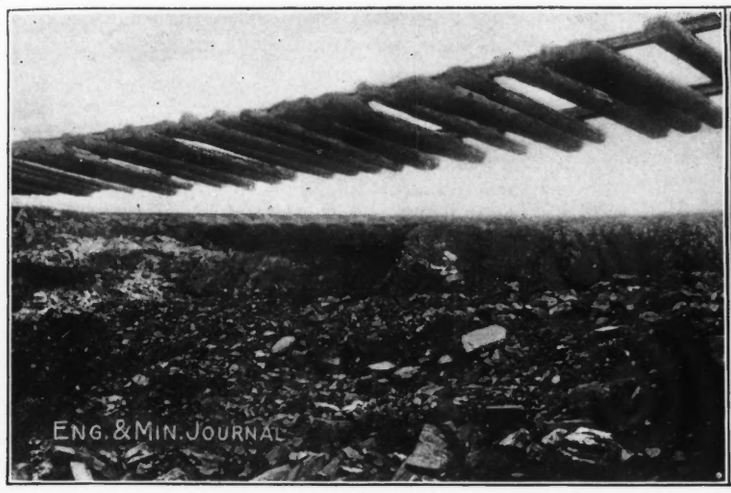
All of the well managed openpits are noteworthy engineering achievements. The ingenuity and foresight necessary to their intelligent development is difficult to over-estimate. The mere engineering problem is not the only one. It would not be so difficult to figure out the shape of the pit, the approach, the track layout, etc., from the engineering standpoint alone. The great trouble comes from the fact that the ore is not uniform and cannot be mined out systematically as the shovels come to it. The mine is subject always to the whim of the furnace, demanding this or that grade of ore, so that the best calculations of the engineer are often upset and irregular and unsystematic working results.

The Commodore is a striking example of an openpit stripped and mined under difficulties. The property comprises only one forty and on that is situated the open pit, a stripping dump which took care of about half the overburden, and the mine buildings. The stripping dump was built up without going off the forty except for a few feet of tail track. The 300-ft. difference of elevation between the top of the dump and the bottom of the pit is

almost a sheer drop and the pit being small in its other dimensions, a striking effect results.

Openpit Equipment

The cars now used for stripping operations are always of the flat-bottom, high-set, side-dump type, of almost every capacity up to 20 cu.yd. The larger, heavier cars are coming more and more into use and these, fitted with air brakes and air dumps, may now be considered standard.



A Result of the Slicing System, the Surface Caved from under a Railroad Track

An Old Inclined Shaft in the Genoa Pit Uncovered by the Steam Shovel

Wooden Tower Headframe at Chisholm Mine. Sheave Tower at Right

Modern Steel Two-Post Headframe at Morton Mine. Note Four Different Trestles

The Boom and Front of an Atlantic Shovel. Two Wire Ropes and Large Sheave

The ordinary rod locomotive is the standard engine for hauling both stripping and ore cars out of the pit. At the Commodore mine, however, and at the Hanna, geared locomotives of the Shay type, built by the Lima company, are in use, those at the Commodore being the heaviest. The approach here is short and the grades steep and the geared type shows to excellent advantage. While it runs slower, it can overcome greater grades with the same load than can a rod locomotive of corresponding weight. Certain other points are worthy of mention. The weight of the engine is distributed over a much longer wheel base, 40 ft. as against about 9 ft. for the ordinary type. The wheel base to be considered in rounding curves, however, that is, the distance between centers of a pair of rigidly connected drivers, is only 5 ft. Since the tender is mounted on drivers, its weight is effective for traction. The Commodore engines can start a train of four loaded cars on a 6% grade. The rod locomotive to do this would have to back down a level tail track, which may not exist, and take the grade on the run. Once under way it makes a faster run than the geared engine but it has not the punch to overcome difficult conditions.

Types and Makes of Steam Shovels

The steam shovels used are of three different makes and of three or four different types, not corresponding to the makes, however. The makes are Marion, Bucyrus

and Atlantic. The types are the old-style Marion and Bucyrus, the Robinson of the Atlantic company, the turntable Marion and, if it be called a shovel, the locomotive crane with clam-shell bucket. Most of the shovels in use are the old-style Marion or Bucyrus. These are alike in principle and in general design, differing, however, in a good many details. The boom is rotated on the front of the shovel, the dipper is hoisted with a chain over blocks and the main engine is placed on the body of the shovel. The Robinson, or Atlantic type, carries a large double-groove sheave on the end of the boom, hoists the dipper direct with two wire ropes over this sheave, eliminating the blocks, and mounts the main engine on the base of the boom. The Marion turntable is a small shovel of standard type but applied on the Mesabi for the first time in 1913, for cleaning up the last of the overburden on the ore surface. It differs from the other Marion shovels in being capable of rotation as a whole, the boom, engine and boiler all swinging together. It is thus much more flexible and has gained a surprising success in its special field. The locomotive crane with grab bucket is used only by Butler Bros. for cleaning up in stripping, just as they use the turntable Marion.

It is impossible to get a consensus of opinion as to the relative merits of the Marion and Bucyrus types, on the one hand, and the Atlantic on the other. All admit that either the Marion or the Bucyrus is a satisfactory shovel, while as to the Atlantic opinions differ. It will be heard that the Atlantic is a faster loader, that it is not so fast, that it is stronger, that it is not so strong, that it is good for ore and stockpiles but will not stand up in stripping, that it has a higher effective lift and that it consumes less coal. It is pretty generally admitted that it consumes less coal, but many hold that this is the last point to consider in a shovel, the main considerations being ruggedness and freedom from breakdowns that entail stoppages. This is true, but if fuel economy can be had without any loss of strength, it is worth having. The facts seem to be that the Atlantic is a little faster in good ground, that it is not quite so strong and that its extra lift is not taken advantage of. There would seem to be nothing inherently weak in its design; the history of the other makes has been a strengthening of one part after another as experience indicated and a steady increase in weight. The three Atlantic shovels originally introduced are still the only ones at work, so far as known, and there has been no chance to strengthen the design.

As to the respective merits of the Bucyrus and Marion makes, opinions differ. The steam shovel, however, of any type is a wonderful machine. To see it eat into a bank of ore or overburden or into a stockpile is a revelation as to what mucking may be.

Openpit Drilling Methods

Both overburden and ore in the pits in general require drilling and blasting. In ore, it is most common to use a jumper drill for vertical holes on the top of the bank; this is a long bar of drill steel with a chisel bit on each end; it is raised and dropped in the hole by a group of men, usually four. The ore is not hard and the method seems fairly efficient. When the hole reaches the desired depth, it is sprung at the bottom with dynamite to get a chamber and then charged with black powder and blasted with electricity as one of a group. In the overburden this method is seldom feasible and recourse is had to the more painful process of gopher-holing. This consists of working into the foot of the bank at an inclination of about 10° a hole 10 to 14 in. in diameter. This is done with a long-handled shovel in soft stuff, and in hard by making a small hole with an auger or long moil and blasting it as made, a foot or so at a time, with dynamite, so as to obtain the full diameter necessary. These holes are chambered at the bottom and blasted as are the vertical holes. Where extremely hard material or actual rock is to be removed, piston drills on tripods are used. No attempt has been made to employ churn drills for blasting purposes and with the relatively low benches carried, they would not seem to be applicable.

Milling Method

Old-style milling is not practiced alone at any mine today, so far as known. In practically every case, where used at all, it is supplemented with some other method. The Albany is perhaps the most typical milling mine, in that it was milled from the beginning, after having been stripped. Here two rows of raises, 20 or 30 in all, come to the surface in the form of craters down the center of the pit and the ore on the crater sides is milled, in most cases by blasting and working down with a pick. Around the edges of the pit a steam shovel works, loading into side-dump cars the ore that is too far back to run into the mills; the cars are hauled to a mill hole which lies over one of the inclined shafts and are there dumped, the ore being hoisted in skips. Another inclined shaft handles the ore from the mill holes proper. The mine is developed by two parallel drifts with crosscuts between them, each crosscut serving two of the raises or mill holes. The ore is trammed by mules from these raises to the shaft pocket. Since operations began, the bottom of the pit has been lowered a long distance and at present the area available for milling to the existing level is restricted. One of the shafts has already been sunk to open a new level and when this is developed, the ore will be milled to that point.

Exploration and Development

Exploration on the Mesabi proper is conducted wholly with drills. The original prospecting was also chiefly drilling and the work has been systematized and standardized to a remarkable degree. A whole campaign of stripping, steam-shoveling, sinking, drifting and mining will be mapped out on the records of the holes drilled in the deposit and can be followed through with remarkable fidelity. The nature of the occurrence of the ore, in flat shallow lenses, is, of course, ideal for drilling. In most important points, the operator when he begins work after drilling knows about what he is to encounter. Accidents, of course, happen; the holes are not spaced to show the last details of the shape of the orebody; the behavior of the overburden, especially in sinking, is always a matter of anxiety; and the amount of water to be encountered cannot be certainly known. On the Western Mesabi, where the wash ores predominate, conditions are different. The drill samples do not show accurately either the grade or the character of the ore encountered and a certain amount of underground exploration is necessary.

Underground development, in general, is strictly development, that is, the preparation of the deposit for

mining. Such development work includes usually a shaft, shaft station and pump room, two principal haulage drifts with crosscuts on the main level, raises, and drifts and crosscuts on the sublevels. As much as possible of this work is in ore. In many cases there is practically no rock work done. The Mesabi miner shuns rock as the devil is reputed to shun holy water. A little hatful of waste rock will represent the surface dump of a mine producing 300,000 tons per year. This development work is cheaply done; often hand drilling or auger work is all that is required; the workings are of generous proportions and the amount of ore thus secured is considerable. Shipping is usually possible in a few months after sinking starts. Round timber is used almost exclusively for development as well as for mining except in the shafts and stations.

Top-Slicing a Clean System of Mining

The slicing method is a remarkably clean system of mining. Of course, nothing is comparable with openpit work in this respect, where in the light of day no stray corners of ore need be overlooked. Nevertheless, in a well managed underground mine, little or no ore is wasted. Extractions of 98% are mentioned; 95% is often given as a round figure for the range as a whole. One may be somewhat skeptical as to whether 5% covers the loss over the entire district, since instances of large bunches of ore being left are constantly quoted. Still there is probably no district where cleaner underground mining is consistently carried on. The mineral conservationist may point with pride to such mining, as an instance of what may be done; the attitude of the forest conservationist might be somewhat different; the clean mining involves the sacrifice of an enormous amount of timber. If the timber were thus consumed merely for the purpose of obtaining the high extraction, the practice could not be justified from the point of view of the general conservationist. But as a matter of fact, a good deal of timber must be used to mine at all in ores so soft as these and the drift-set slicing method seems as economical in timber as any that could be devised.

It is probably fair to say that the fee owners in the first place, more or less directly, compelled the clean mining. Naturally, a fee owner wants every pound of ore extracted and not left inaccessible to him or others. He does not get the very last pound, but his attempt to do so helps to keep the mining companies up to scratch. However, it is not out of respect to the desires of fee owners that the top-slicing method is now so universally followed; the mining companies find it to their own advantage to leave no ore behind.

Square-Set and Drift-Set Slicing

The distinction between square-set and drift-set slicing as representing two systems of underground mining is rather finely drawn. There is little real difference except in the details of the timbering itself and the change is made continually from one method to the other and back again in the same mine as occasion warrants. The square sets are true square sets; the drift sets differ in being larger and in having no studdles and sills; the square sets in a room, furthermore, may be several tiers high. The choice is chiefly a question of the height of the slice to be extracted. Thus both the top and the bottom of an orebody may dip slightly toward the shaft, but the top more steeply than the bottom so that an increasing thickness is obtained. Mining at the edge of the deposit will begin on the highest sublevel and square sets may be used, then or soon after. Working back toward the shaft, the top of the ore drops until the height of the slice is such that drift sets may be placed. Retreating with the drift sets, their height decreases until it reaches perhaps 4 ft. Slicing on that level is then stopped until the sublevel next below is worked back to that point. Then since the combined height of the two levels is too great to extract with drift sets, square sets from the lower level will be used and both levels extracted with two tiers of square sets. When the thickness of the slice has again decreased so that the drift sets are applicable, the change back is made and this process may be repeated under certain conditions.

The square-set method is usually considered the more expensive, as involving a greater consumption of timber. This is largely offset, however, by the fact that chutes can be constructed through the square sets and much expensive shoveling avoided. The amount of shoveling necessary is the great drawback to the slicing system. This is well recognized and attempts are being made to solve the problem by the development of shoveling machines or mechanical muckers.

Sinking Is Difficult

Sinking on the Mesabi, as elsewhere, is a serious business. The shafts are shallow, but the overburden is loose and treacherous and the water flow is often heavy. Ordinarily a shaft can be sunk and timbered with regulation open sets and lagging. In passing through quicksand, close cribbing is put in and resort is had to a shoe, forced down with jacks from the bottom of the cribbing and carrying a shield which extends up outside the cribbing, so that only the bottom of the shaft is exposed. Such ground is handled with extreme care and progress is slow. Sometimes a central well is kept ahead of the shaft proper to drain the immediately surrounding ground.

The last resort in difficult sinking is the New York Foundation Co., with its drop shaft and caisson method. This highly developed system is effective but it is also expensive. A concrete shaft thus dropped is usually turned over to the mining company, sealed to solid rock or ore. What happens after it is accepted and sinking begins on company account is not always told, but this sequel is often the real story. A case in point is the history of the Syracuse shaft as related by Professor van Barneveld.[1] Others, no less interesting, cannot be published.

(To be continued.)

Silver Ore near Marienbad

Special Correspondence

A Swiss company owning the Kuttenplan mine near Marienbad, Bohemia, hitherto known as a lead mine only, has had the good fortune to strike several veins of rich silver ore. A mill run made of it at Muldener Hütte, Freiberg, Saxony, yielded at the rate of 2.75% or, say 802 oz. of silver per short ton. In consequence, the Saxon mines administration has made an offer to the company to take its whole output without any dressing at exceptionally favorable rates.

[1] "Iron Mining in Minnesota."

Locating Outcrops with a Transit

By Walter Scott Weeks*

SYNOPSIS—Method of tracing an outcrop using a Shattuck solar attachment and a method in which a top telescope is used instead of a solar attachment.

It is a well known fact that the outcrop of a vein of uniform dip and strike, which traverses uneven country, swings toward the foot-wall side as the elevation of the ground increases, and swings toward the hanging-wall side as the elevation of the ground decreases. For exploration it is often desirable to trace the line where such a vein would outcrop if it came to the surface, and to plot the position of this line on a map. This article deals with two methods of locating points on such a line; one by means of the Shattuck solar attachment, and one by means of the ordinary top telescope. The Shattuck method will be described first.

Vein Tracing with a Shattuck Solar Attachment

The Shattuck solar attachment is a combination of two small mirrors so arranged that, when it is placed on the end of the telescope, the line of collimation is deflected through any desired angle. For the purpose of vein tracing, the line of collimation is deflected 90°, so that, when the Shattuck is revolved, the deflected line of collimation generates a plane, which is at right angles to the telescope. The transit must be carefully adjusted, and particular care must be exercised in making the line of collimation parallel to the long axis of the telescope, otherwise the deflected line of collimation will not generate a plane at right angles to the telescope.

The principle of vein tracing is simple. The transit is set up over the center line of the outcrop. The long axis of the telescope is made perpendicular to the strike. By strike is meant the direction of the line of intersection of the vein with a horizontal plane. The telescope is next turned down until its axis is perpendicular to the dip of the vein. The deflected line of collimation will now revolve in the plane of the vein and the line may be staked. If the ground is sighted, each stake will be slightly off the line owing to the fact that the line of collimation does not generate the plane that passes through the stake over which the transit is set up, but a parallel plane. This error is slight when the outcrop is traced from one setup, but when many are required, the error is cumulative.

Thus it is a simple matter when the vein is staked from one setup. When, however, it is desired to run our line for several miles through wooded country, the problem becomes more difficult. An actual example is here cited and the complications in the order in which they arise are discussed.

The limb of the transit is graduated from 0° to 360° in a clockwise direction. The *A* vernier is beneath the eye-piece and the *B* vernier is beneath the objective. The strike of the vein is N 5 deg. 19 min. E and the dip is 68 deg. to the east. The problem is to stake the outcrop and tie in each stake with a traverse line. The azimuth is carried along by measuring the horizontal angle in a clockwise direction between the back-sight line and the front-sight line. The elevations are carried along by means of vertical angles and taping along the line of sight. The above data are ample for the calculations of latitude and longitude. The accompanying table shows the abbreviated office notes of an actual survey.

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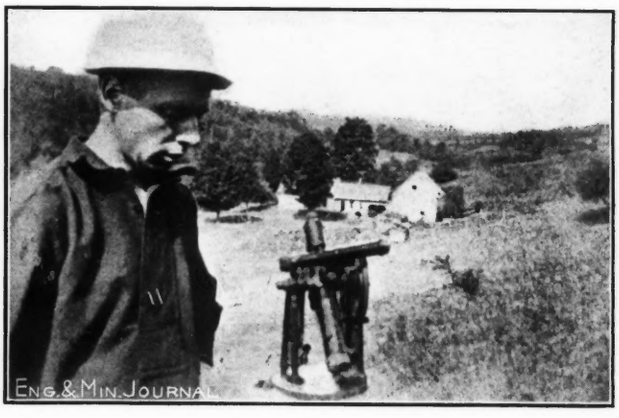
Directions for Making Observations

Suppose a setup has been made on Sta. 2, back-sighting on Sta. 1. The bearing of the line from Sta. 1 to Sta. 2 is N 21 min. W. The first problem is to set Sta. 3 with the Shattuck. The procedure is as follows: Set the *A* vernier at zero and back-sight on Sta. 1 with the upper motion clamped and the telescope plunged. Plunge back. The telescope is now in its regular position and looking along a line N 21 min. W. The telescope must now be turned so that it will be perpendicular to the strike and dip.

Referring to Fig. 1, the relations of the various lines will be seen. It is desired to turn the telescope in the direction of the full arrow in the figure. That means turn it to the left through the angle *a*, which is 84 deg.



Transit with Shattuck Solar Attachment

20 min. In order to do this the *A* vernier is set at 275 deg. 40 min. Next the telescope is turned down 22 deg.; it is then perpendicular to the plane of the vein. Now the Shattuck is put on, which has been set to deflect the line of collimation through 90 deg. The surveyor is now ready to set Sta. 3. It is the desire to carry along the outcrop of the plane that passes through the stake at Sta. 2. If the ground is sighted the outcrop of a plane that passes through the end of the telescope will be located. To locate the true outcrop, sight at a target on a rod set at the height where the line of sight of the Shattuck intersects the plumb-bob string of the transit. The bottom of the rod then locates Sta. 3. After the stake is set, it is necessary to tie it to the traverse. Take off the Shattuck and sight at Sta. 3. The horizontal angle is read on the *B* vernier. Next take the height of instrument, height of point, vertical angle and tape distance and the instrument work is done.

It is possible to check in the field the accuracy of the work and this is desirable in all cases. Sta. 3 would be checked as follows: The azimuth of the line 1-2 is 359

deg. 39 min. Hence the azimuth of the line Sta. 2-Sta. 3 is 359 deg. 39 min. + 180 deg. + 181 deg. 8 min. = 720 deg. 47 min., and its bearing is N 47 min. E. Consulting the notes it will be seen that in going from Sta. 2 to Sta. 3 swinging off from the strike of the vein has been done to the extent of 4 deg. 32 min., as shown in Fig. 2. The horizontal distance that Sta. 3 has been offset from the line of the strike that passes through Sta. 2 is the distance *a* in Fig. 2. $a = 255.55 \times \sin 4$ deg. 32 min. = 20.20. From the notes it will be seen that between Sta. 2 and Sta. 3 there is a rise 49.94 ft. The dip of the vein is 68 deg. The theoretical distance that should be offset is $C - b$ in Fig. 3 — 40.94 × tan 22 deg. = 20.18—. The actual offset on the ground has already been found to be 20.20. If the work is done correctly *a* in Fig. 2 should be equal to *b* in Fig. 3.

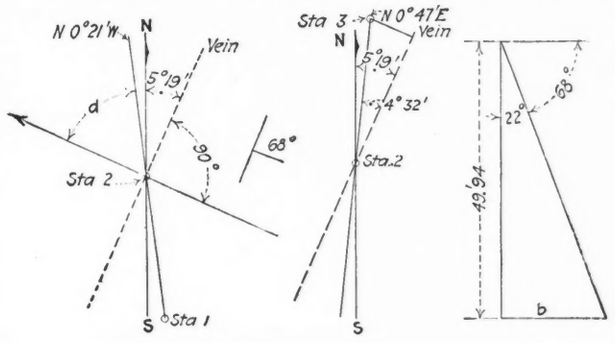


FIG.1 FIG 2 FIG.3

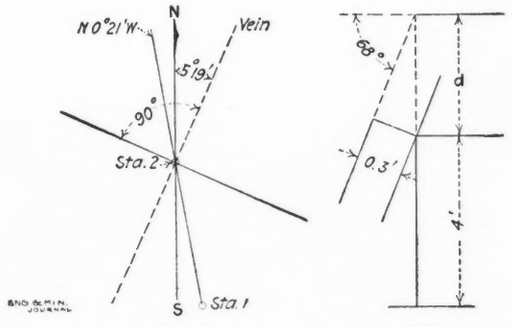


FIG 4 FIG.5

In dark woods it is difficult to pick up the rod with the Shattuck. I have found it most satisfactory to locate the station approximately with a red flag and then to use the rod. It is best to advance by 300-ft. sights when possible and to place only one station ahead from a setup. It is difficult to see with the Shattuck in dark places and in cloudy weather, and so progress is often slow. For this reason I devised the following method applicable to most instruments with top telescopes.

Method with Transits with Top Telescopes

Loosen the capstan screw on the top telescope adjustment so that the top telescope will revolve in a plane perpendicular to the vertical axis of the transit when it is set up with the main telescope level. Now if the main telescope is made perpendicular to the strike and turned so that it looks directly down the dip, the top telescope will revolve in the plane of the vein and the stations can be set with a clear-visioned, high-powered telescope.

In using this method great care must be exercised in making the line of collimation of the main telescope parallel to the long axis of the telescope. The line of collimation of the top telescope should be made parallel to the line of collimation of the main telescope. If the lines of collimation are not parallel to the telescopes, when the top telescope is revolved, its line of collimation will generate a cone instead of a plane.

The degree of accuracy with which the line of collimation of the top telescope generates the correct plane may be tested in the following way: Set up the transit and level the main telescope. Sight the horizontal cross-hair of the top telescope on a point 300 ft. away and revolve the limb of the transit through 360 deg., holding the top telescope in the same position. The distance that the cross-hair leaves the point is the amount of error made in placing a station 300 ft. away. From the nature of the work it is evident that an error of an inch or so is of no significance.

Let us now see how a station is set by this method. We are set up on Sta. 2. We wish to get the telescope perpendicular to the strike so that it can be pointed directly down the dip. Proceed as in the previous case until the telescope is looking N 0 deg. 21 min. W with the *A* vernier at zero. Set *A* vernier at 95 deg. 40 min. and the telescope will be perpendicular to the strike and pointed in the direction of the full arrow in Fig. 4. Tip down 68 deg. and the telescope is pointing down the dip. The outcrop can now be staked with the top telescope. There is one other point to note. At what height above the ground must we sight in order to carry along the proper plane? We must sight at a point on a rod which is at the height of the intersection of the line of sight of the top telescope and the plumb-bob string produced upward, Fig. 5. Suppose the head of the instrument is 4 ft. above the stake, the telescope is tilted down 68 deg. and the distance between the main and the top telescopes is 0.3 ft. The distance from the head of the instrument up to the point of intersection is the distance *a* in Fig. 5. $a = \frac{0.3}{\sin 22^\circ} = 0.8$ ft. This is a constant for a given instrument and given dip. In this case we sight at the target set 4.8 ft. above the ground. The work of carrying along the traverse is the same as in the case of the Shattuck. The work should be checked as before. To work rapidly the following men are needed: An instrument man, two chainmen, two men to calculate angles and check the work, and as many axe men as the character of the country demands.

SPECIMEN OF NOTEBOOK ENTRY

Sta.	Back-Sight	Front-Sight	Hor. Angle	True Bear.	Calculated Vert. Dist. between Sta's	Calculated Hor. Dist. between Sta's
1		2		N0°21'W		
2	1	3	181°8'	N0°47'E	+49.94	255.55
3	2	4	181°16'	N2°3'E	+20.60	144.51

Spanish Potash Deposits

It seems indisputable, says the *Revista Minera*, that deposits of potash salts discovered in various parts of Catalonia, in the provinces of Barcelona and Levida, are of genuine importanee. The origin was the work of practical investigation in the famous deposit of gemme salt at Cardona, where chloride and sulphate of potash were discovered. Since then surface deposits of salts have been encountered, as already mentioned, in Suria, above the Cardoner and at Pons Guisona, and other points of the Sejoe basin. Numerous companies have

registered some thousands of hectares, principally the Sociedad Anonima Cros, of Barcelona, and two other companies, one at Bordeaux and the other German. It is early to judge of the true importance of these deposits, and some time must elapse before their value can be estimated. However, some aseribe the fall in the shares of the Stassfurt mines to the discoveries in Catalonia.

Lake Iron Ores in 1913

The rail shipments from iron mines in the Lake Superior region have just been reported. They reached a total of 876,638 tons, which, added to the Lake movement made the total for the season 49,947,116 tons, the largest quantity ever reported in a year. According to the official figures, as compiled by the "Iron Trade Review," the division of the year's shipments by ranges were as follows, to which are added the total shipments by ranges from the first opening up to the beginning of the present year.

	Year Opened	1913 Tons	1913 Per ct.	Total to date Tons	Total to date Per ct.
Marquette	1850	3,966,680	7.9	107,298,819	17.2
Menominee	1877	4,965,604	9.9	89,045,011	14.2
Gogebic	1884	4,531,558	9.1	77,267,211	12.4
Vermillion	1884	1,566,600	3.1	34,829,073	5.6
Mesabi	1892	34,038,643	68.2	313,084,778	50.2
Cuyuna	1911	733,021	1.5	1,185,563	0.2
Baraboo	1903	145,010	0.3	1,336,979	0.2
Total		49,947,116	100.0	624,047,434	100.0

As compared with 1912 the Marquette, the Gogebic and the Vermillion ranges showed decreases in shipments; the other ranges all had increases. The gain in total shipments was 1,725,570 tons, or 3.6%. The increase in water shipments was 1,634,701 tons, and in rail shipments 90,869 tons.

The independent shippers last year, as in 1912, slightly exceeded the Steel Corporation, mining 50.94% of the total against 49.06% for the Corporation.

The Steel Corporation mined from the Hill leases 5,150,000 tons. The total minimum tonnage required under those leases up to the close of 1913 was 21,000,000 tons; the total mined up to that date was 20,472,647 tons, so that the Corporation is still 527,353 tons short of its minimum, and to come out even must mine over 6,500,000 tons from those lands this year.

There were 223 mines shipping in 1913, of which 110 were on the Mesabi range. The four leading shippers—all on the Mesabi—were the Hull-Rust, 3,457,608 tons; the Sauntry-Alpena, 1,705,131; the Adams, 1,580,196; the Mahoning, 1,515,428 tons.

Shipments from Canadian mines, not included in the table were: Helen, on the Michipicoten range, 42,550 tons; Magpie, on the same range, 19,934; Moose Mountain, 102,238; total, 164,722 tons.

Norwegian Nitrate

SPECIAL CORRESPONDENCE

At an extraordinary general meeting of "Det Norske Aktieselskap for Elektrokemisk Industri" held in Christiania on January 20, it was decided further to inerease the capital of the company by $335,000.

A Norwegian paper is responsible for the statement that a combine of German nitrate interests, headed by the Badische Anilen-und-Sodafabrik, has been arranged to keep out competitors, and that the Germans have secured a method of production, which, unlike that of Norway and Sweden, is entirely independent of electric energy. Works will be ereeted for an output of from 30,000 to 60,000 tons annually. The Norwegian annual output is 80,000 tons. The engineers of the Nitrogen Products & Carbide Co. have recently completed their survey of the Dettifos falls in Iceland, where it is the intention of the company to supplement the Odda output in Norway—though on a much larger scale. The Dettifos falls is about 410,000 hp.

New Cornelia Copper Co.*

Exhaustive work has been done during the last year to check the grade of ore of the New Cornelia Copper Co.'s property at Ajo, obtained by sampling the material from the extensive system of drill holes previously sunk. Test shafts were sunk on alternate drill holes to water level. Two shafts were sunk to greater depth, and about 1500 ft. of drilling was done from these shafts to test the grade of sulphide ores. All material coming from shafts and drifts was sampled, and afterward most careful hand sampling was done in all the openings. The result of this check sampling confirmed the results of drill sampling in a most satisfactory way.

Two wells have been drilled up to this time, and a third has been started to develop water in the broad desert valley immediately below the mines. In the first well water has been encountered apparently in quantity, but the available supply cannot be determined until a high-pressure air plant is installed at this well to make a definite test of long duration by raising the water with an air lift. The water was encountered at between 500 and 700 ft. from surface. There is water available in abundance, but it is at further distance from the mines. The minimum requirements are about 500 gal. per minute.

On July 23, a railroad-engineering crew was put in the field to make a preliminary survey and estimate of cost of constructing a railroad from Tucson to Ajo, which would connect with the El Paso & Southwestern and Southern Pacific railroads at Tucson, and from Ajo northward, which would connect with the latter railroad in the vicinity of Gila Bend. The work was completed on Dec. 22, 1913. Both routes were found feasible with grades not to exceed 1%, and curvatures not in excess of three degrees.

The carbonate ores, which form about 25% of the total tonnage development, will be leached. The copper may be precipitated from solution by metallic iron and produced commercially at a reasonable cost, but the company is experimenting with a different method of precipitating the copper, which, if successful, will result in a great saving in cost over precipitating with iron and will also in a large part regenerate the acid used in leaching. If this method proves practicable, it will, of course, supplant the present plan of precipitating with iron. From experiments by flotation methods, the Ajo sulphide ores are found to give a high recovery.

Work for the past year has demonstrated the fact that the Calumet & Arizona Mining Co., in its purchase of the New Cornelia copper company's property, at Ajo, has secured one of the great low-grade porphyry mines, which will be a source of continued revenue to its stockholders.

*Note—From the annual report of the Calumet & Arizona Mining Co.

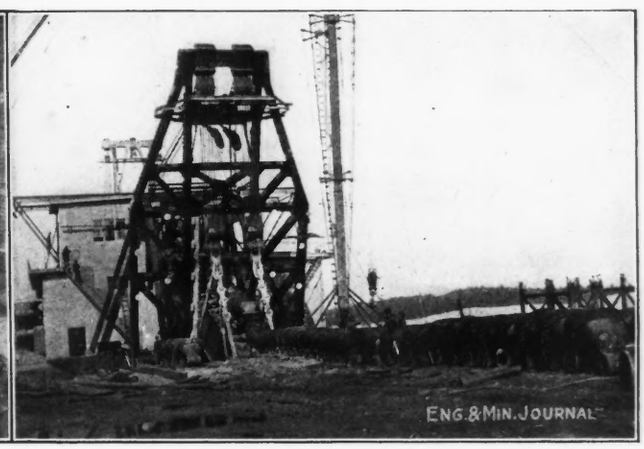
The Construction of an All-Steel Dredge--II

By Lewis H. Eddy*

SYNOPSIS—Description of the operating machinery of Yuba No. 14 all-steel bucket-elevator dredge, installed at Hammonton, Calif., Dec. 17, 1913. Construction and installation of this machinery, including also the driving machinery and electric power and lighting equipment, was completed in three months elapsed time.

The construction and installation of the operating and driving machinery (including the electrical equipment) of Yuba No. 14 all-steel 16-cu.ft. bucket-elevator dredge at Hammonton, Calif., was completed in three months elapsed time, from Sept. 17, the date of hull flotation, to Dec. 17, the date of entire completion of the dredge, making the total elapsed time, four months and four days. Deck riveting was finished on Sept. 23 and on that date the superstructure was 75% completed. At the end of October the dredge was ready for installation of spuds, gantries and ladders. The bucket line was installed on Dec. 13 and the tailing stacker on Dec. 16. It is usual practice to install the stacker in advance of the bucket line, but the small size of the pond due to the proximity of Yuba River necessitated the reverse.

Section of the Construction Yard



Installing the Bucket Line

Details of Gantry Construction

The bow gantry is of four-legged type built of steel and footed in castings amounted on deck, two on each side of the well hole. The footings are supported by cross bulkheads inboard of the well-hole pontoons. The head of the gantry is supported by back guys attached to the main fore-and-aft hull trusses. The guy fittings are composed of steel sheaves and takeups for two sets of four parts of rope each, from bow gantry to point of attachment on main truss. The gantry is mounted with new design of platform, situated about 10 ft. below the center of the cap, which was first introduced in California dredge construction of Natoma No. 10. The platform has a maximum length of 27 ft. and has 507 sq.ft. of floor space. The flooring is built of 3x12-in. planks, leaving spaces for the ladder hangers. The floor frame is made of 6-in. 8-lb. channels 21 ft. long, braced underneath on the forward side with 6-in. 8-lb. channels 11 ft. 4 in. long. The entire platform is surrounded by pipe railing. This platform not only enables workmen to get about the head of the gantry, but provides space for repair work and saves the time necessary on other boats of lowering the parts to deck for repair.

The stern gantry is composed of two steel posts made up of 15-in. channels latticed with cross bracing between. The cap is box-girder type made up of angles and plates connected at the bottom with the upper hull chords by 6-in. pins. This is the regular bridge-truss system of tying the boat together. The gantry is mounted on the upper chords of the fore-and-aft trusses. It is guyed to these trusses by steel cables. Guy fittings are provided for attaching the guy ropes to the gantry and to the main truss.

The construction of the main gantry was necessarily included in the hull construction and was a part of the superstructure carried by the hull when floated. It is, however, a constituent part of the operating machinery. The main gantry posts are vertical posts under the upper tumble. The main drive is on the top chords directly over the back of the well hole. The gantry is supported by four vertical posts on the forward end, and two batter posts support the after end. That part of the gantry is a continuation of the upper chords. The two chords are connected by a horizontal cross girder and a vertical cross girder made up of angles and plate steel.

Box-Type Spuds Weighing 80,000 Lb. Each

The spuds are box type, alike in design and approximately of the same weight, the digging spud being a little heavier than the stepping spud. The total weight, including spud points, is about 80,000 lb. each. They are each 62 ft. long, 38 in. wide, 60 in. deep, built up of steel plates and angles, with cast-steel diaphragms and

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spud points; and are so situated on the dredge as to deliver the spud reaction uniformly to the main truss system. The side plates are ½ in. thick, 60 in. wide; the end plates are 1 in. thick, 37 in. wide. The spud points are 10 ft. long and weigh 6 tons each. The sheave blocks for lowering and raising the spuds are of cast steel, with turned grooves. The sheaves are attached to the stern gantry cap by collar bars of steel embracing the cap to which the stacker suspension bars and guy tackle are attached. The tailing stacker being situated at the center line, the digging spud is situated to starboard; the stepping spud to port.

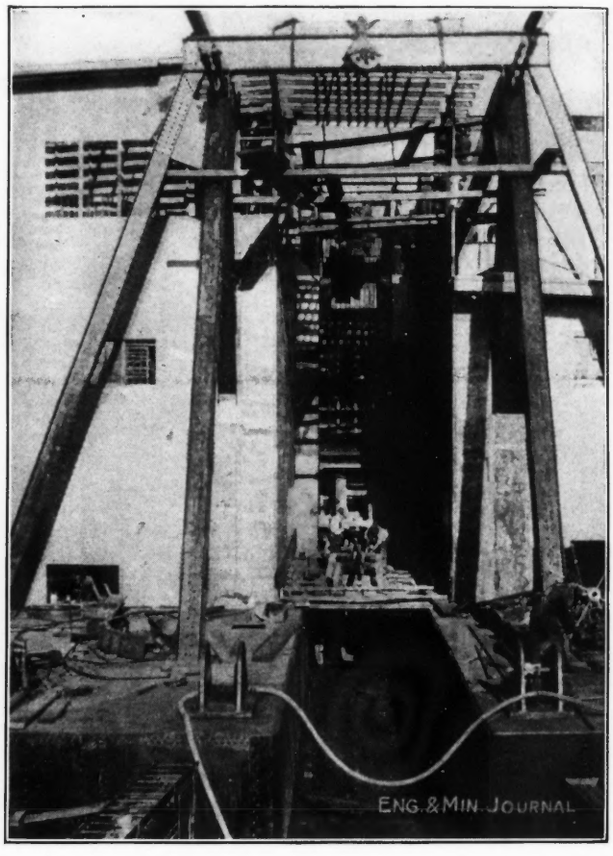
The like design and weight of the spuds and their relative situation provide for uninterrupted digging, by use of the stepping spud in case a break or ordinary repair necessitates the suspension of the digging spud. The spuds are practically interchangeable, or may be so employed in case there is necessity for such employment. The situation of the spout of the stacker hopper on the center line of the boat is also considered the best practice, in this field.

Description of Digging Ladder and Tumblers

The digging ladder is of plate-girder type, 134 ft. long between centers, 5 ft. 6 in. wide between perpendiculars, 8 ft. 7¼ in. depth over all. The materials conform to railway-bridge standard specifications. Openhearth steel castings at the end of the ladder carrying the lower tumbler bearings are provided with manganese-steel wearing plates on the top flanges. The ladder is hung concentrically about the upper tumbler shaft in order to give constant even lead of the buckets to the upper tumbler and eliminate pounding of the buckets on the upper ladder rollers when the angle of the lead of the bucket line to the upper tumbler is changed, which occurs as the ladder is raised and lowered. This design has been adopted on Natomas 8 and 10 and proved to strengthen and simplify construction greatly. The concentrated ladder suspension is so designed that it will not produce torsional or eccentric stresses on the ladder supports or main truss. There are two main suspension pins; the forward one is 12-in. diameter; the after one is 8-in. diameter. The ladder is provided with 18 rollers of 16-in. diameter and spaced about 10 ft. apart. The rollers have forged carbon-steel shafts 4⅞ in. diameter running in cast-iron bearings and easily renewable bushings. The lower roller shaft is $5\frac{7}{16}$ in. diameter. There are three guide rollers on each side of the ladder at top and bottom, spaced about 10 ft. apart. These rollers are 12 in. diameter made of openhearth cast steel with forged carbon-steel shafts and cast-steel bearings and renewable cast-iron bushings. These rollers guide the ladder through the well hole. The total weight of the digging ladder, without the bucket line, is 125 tons.

The digging-ladder suspension tackle is double type, provided with a pair of 6-sheave blocks on each side of the ladder, and separate rope leading from each sheave to the ladder hoist drum. The sheaves are cast steel, 48 in. diameter, turned in the grooves and running on carbon-steel pins. The upper blocks are hung from the bow gantry by heavy steel collar bars. The suspension from the lower blocks is by steel shackles and two pairs of heavy bars. The forward hanger bars are built of steel links; the rear bars are in sections and are pin-connected. Safety suspension bars are provided, extending from the lower suspension blocks to the under side of the digging ladder; they are made up of forged steel bars in three sections, connected together with 8-in. pins.

The upper tumbler is of six-sided type. The body is made of single high-carbon steel castings hexagonal in shape and provided with manganese-steel tread and ear plates, bored, and pressed and keyed on to the shaft. The shaft is forged from nickel-steel billets containing 3½% nickel. The upper tumbler support is solid box girder built of steel plates and angles. There are two vertical posts, each of 15-in. 33-lb. channel; two batter posts, each 15-in. 33-lb. channel; two beams, one 15-in.



Lining the Well

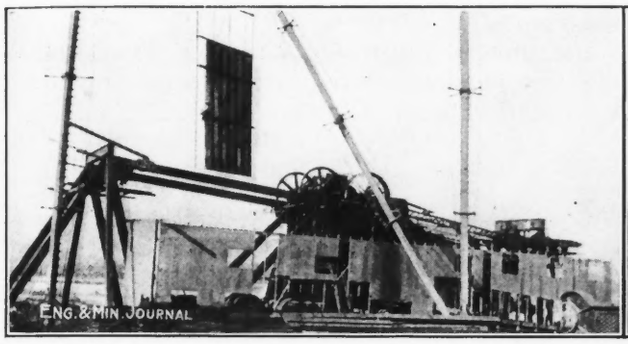
12-lb. channel and one 15-in. 60-lb. channel. The batter posts also support the screen drive and the main hopper. The main hopper support is also provided with three 18-in. 55-lb. I-beams. The upper tumbler and shaft weigh 25,000 lb.

The lower tumbler is made of high-carbon openhearth steel, hexagonal in shape, and carefully annealed. Tread and ear plates are of manganese steel, riveted in place with 1½-in. rivets. The shaft is forged from nickel-steel billets containing 3¼% nickel. A tie-rod passes through the hole in the center of the shaft to prevent spreading of the lower ladder-ends. The shaft runs in babbitted bearings of standard construction now in use on the dredges the Yuba Consolidated Goldfields. The lower tumbler and shaft weight about 20,000 pounds.

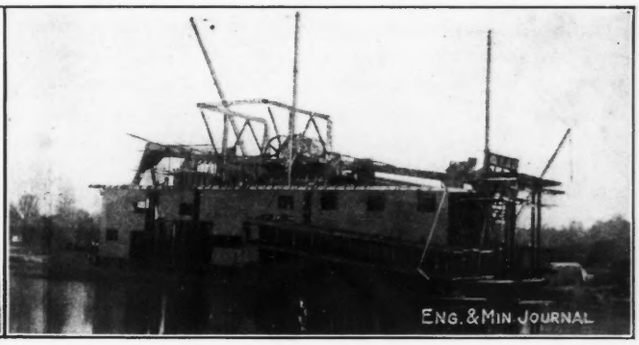
The bucket line is composed of 87 close-connected two-piece buckets of 16-cu.ft. capacity. The bottom and hood of the buckets are nickel-chrome steel one-piece casting,

with manganese-steel insert plates to protect the bottom of the back eye from wear. The lip is a manganese casting 2¼ in. thick on the cutting edge, by 13 in. wide, double riveted to the hood with 1¼-in. rivets. Pitch of bucket about 41 in. The bucket pin is 33 in. long, 7⅜ in. diameter, forged from nickel-chrome steel billets. The pins are heat-treated in accordance with the best modern practice for dredge-bucket pins. Bushings are manganese-steel castings about 1 in. thick. The buckets and bushings weigh about 4250 lb. each; the pins about 425 lb. each, or a total weight of bucket line about 203 tons.

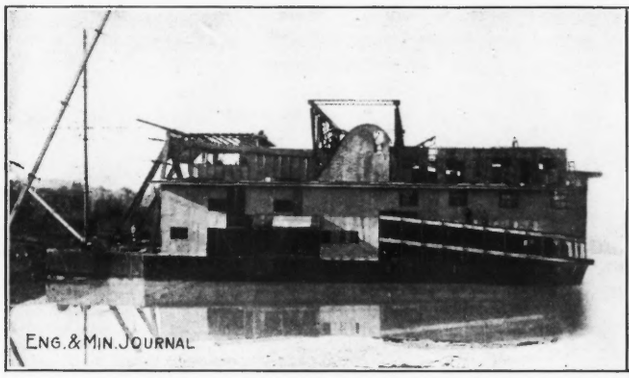
The bucket idler, which holds the bucket line away from the back end of the well hole in deep digging, is



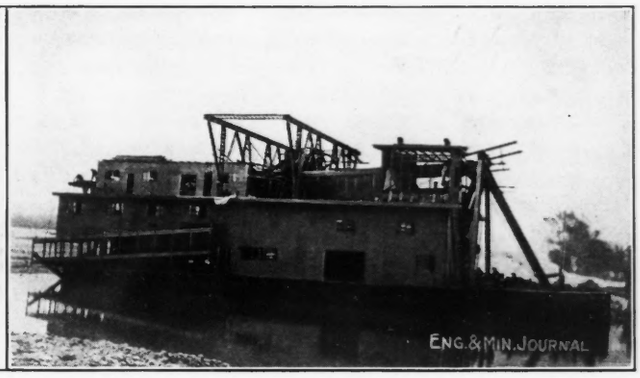
ERECTING STEEL HOUSING IN SECTIONS



SIDING WITH RAFTERS PLACED



WELL-HOLE HOUSING BEING ERECTED ABOVE THE ROOF OF "MAIN" HOUSING



STARBOARD SIDE OF MAIN HOUSE COMPLETE

collar bars on the stern gantry cap. The lower blocks are attached to the ladder by wire-rope slings at the outer end and passing around equalizing sheaves at center. The head and tail pulleys are 36 in. diameter each. The troughing and return idlers are the regular Robins type for 42-in. belt. The ladder is provided on each side with a 24-in. running board and pipe hand rail. The ladder is connected to the driving motor by chain belt. The conveyor belt is 42-in. 3-ply Cocheco brand leather, 276 ft. long, running over two drums.

The main hopper, which receives the gravel from the buckets and delivers to the screen, is built of steel plates and angles and lined on back and sides with renewable plate liners. The discharge spout is supported by heavy

9 ft. 5⅜ in. diameter; 4 ft. 8⅞ in. radius; spider 7 ft. 8 in. across; rim 4 ft. wide. The shaft is 11 ft. long; 9½ in. diameter. The rim, spider and hub are of cast steel; shaft of medium-carbon steel; with babbitted bearings and manganese-steel wearing plates. Total weight of idler bearings and shaft, 26,000 lb. The cover of the idler extends fore-and-aft 8 ft. between the housings; cross-section, 4 feet.

TAILING STACKER AND CONVEYOR BELT

The stacking ladder is of lattice-girder type built up of steel plates and angles and provided with steel castings to receive the upper and lower suspension pins. The ladder is 136 ft. long between centers. Fittings are provided necessary to raise the ladder to a pitch of 18 deg., the suspension tackle allowing the ladder frame to be raised or lowered. The ladder is suspended from the stern gantry cap through a set of cast-steel sheave blocks, especially designed. The upper block is attached to

castings and lined with heavy cast manganese wearing plates. The hopper is supported by three 18-in. 55-lb. I-beams.

The stacking-ladder hopper, which delivers the tailing gravel from the revolving screen to the conveyor belt, is built of plates and angles. The spout is of cast steel, designed to properly deliver the gravel and to minimize the wear on the conveyor belt.

The save-all and grizzly is the latest Yuba Construction Co. type, built of steel plates and angles. Safety bars made of cast steel protect the saveall and grizzly in case of accident to the bucket line. The save-all pans take up the full width of the well hole.

The distributer, placed under the revolving screen for distribution of the gravel passing through the screen to the several sets of gold-saving tables, is built of steel plates and angles, with the plates easily renewable. Water pipes are attached alongside the distributor on each

side, tapering from 8-in. to 6-in. diameter, having spray holes for washing the gold tables.

Revolving Screen and End-Nozzle Washers

The revolving screen is 9 ft. diameter by 50 ft. 6 in. long over all. It is built up of ⅝-in. high-carbon steel plates, with perforations tapering from ⅜ in. on the inside of the screen to ½ in. on the outside. The upper and lower ends of the screen are lined with 1x6-in. steel bars drilled so that they may be reversed. Manganese obstruction rings are provided at the lower end of each screen plate to assist in washing the gravel. Longitudinal manganese bars 1x2 in., spaced 4 1/16 in. apart, are set on the screen plates and 1x6-in. manganese bars provided at their longitudinal joints. The tread bands at the upper and lower ends of the screen are openhearth high-carbon castings properly finished and riveted with 1-in. rivets. The screen is supported at the upper end by two 15-in. 33-lb. channels and two plates 13x⅝ in. The lower end supports are three girders made up of four angles 6x6x⅜ in.; two plates 12½x⅜ in.; web plate 23x⅜ in.; stiffening angles 4x4x⅜ in. The upper support structure at the stern is supported by one plumb post and two batter posts on each side. The forward posts of this group are made up of two 15-in. 33-lb. channels and one 15-in. 22-lb. I-beam. The brace batter posts are made up of two 15-in. 33-lb. channels latticed. The plumb posts are made up of two 15-in. 33-lb. channels and one 15-in. 42-lb. I-beam.

The end-nozzle type of apparatus for washing gravel in the revolving screen is installed on this dredge, as on other dredges in this field. There are six nozzles at the forward end and eight nozzles at the after end of the screen. The nozzles are 3-in. reduced to 2-in. This type of washing apparatus originated in Colorado, but was introduced in California dredging practice first on the boats of the Yuba Consolidated Goldfields.

Double-Bank All-Steel Gold-Saving Tables

The gold-saving tables are the Yuba Construction Co. double-bank type, made entirely of steel with the exception of the wooden part of the riffles, and set on steel frames. The tables are 31¾ in. wide inside and 10 in. deep, made of 3/16-in. steel plates. Height between sets, 6 ft. There are three double-bank steel side sluices and two tail sluices on each side. The riffles are made up of wooden strips shod with steel straps ⅛ in. thick, 1¼ in. wide, 29½ in. long. There are 2600 riffles, 15,600 steel straps, requiring 381,816 nails and 169,200 screws in construction. The tables are surrounded in the usual way with wire screen, 1½-in. mesh, and provided with suitable doors. The tail sluices are suspended by 1000 ft. of ½-in. cast-steel wire rope, using sixty-four ½-in. strand Crosby clips and thirty-two ½-in. galvanized oval thimbles.

Washing and Sluicing Pumps

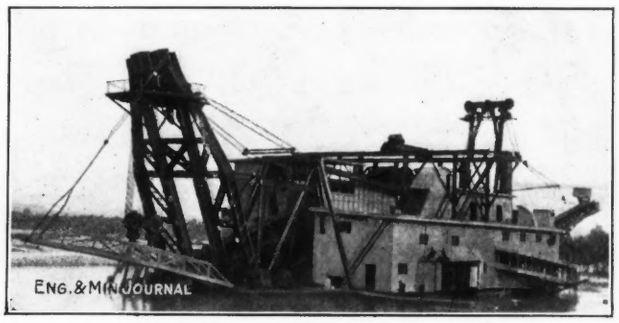
There are seven pumps for washing and sluicing: One 14-in. centrifugal, with base and flexible couplings, direct connected to 150-hp. motor, delivering 5500 gal. per min. against 70-ft. head; one 14-in. centrifugal, with base and flexible couplings, direct connected to 75-h.p. motor, delivering 5500 gal. per min. against 40-ft. head; one 6-in. two-stage centrifugal, with base and flexible couplings, direct connected to 50-hp. motor, delivering 1000 gal. per min, against 120-ft. head; one 6-in. single-stage vertical centrifugal, driven by 10-hp. motor; two 3-in. Rumsey pumps; one 2½-in. double-acting ship pump.

Auxiliary Operating Parts and Fittings

The traveling crane, with hand hoist, for handling the upper tumbler and main drive parts crosses the dredge and extends about 8 in. over the sides; capacity 19 tons. A jib crane is installed at the port bow for handling buckets.

The bow fairleads are of radial-arm type, similar in design to those on Yuba No. 13. All sheaves for guiding ropes are of cast steel, machine-grooved and interchangeable as far as practicable; and all are brass-bushed where necessary.

More than 10,000 ft. of wire rope and about 1000 ft. of rubber and leather belting are in use.



The Completed Dredge

All grease cups are of pressed steel. A grease pump is provided for lubricating the lower tumbler bearings.

The footbridge is 60 ft. long, 60 in. wide, built of wood, provided with side rails, and raised and lowered with a hand winch. It is suspended by ½-in. cast-steel wire rope, using 360 ft. of wire rope and two ½-in. Crosby clips.

(To be concluded)

A Bill for New Mining Laws

The Senate committee on mines and mining, of which Senator Walsh is chairman, has reported with amendments the Smoot bill, providing for the creation of a commission to codify and suggest amendments to the mining laws of the United States. In its proposed form the bill provides for a commission of three, two of which shall be lawyers of experience in mining law and one a mining engineer, experienced in the operation of mines.

The bill continues as follows to this effect: It shall be the duty of the commission so appointed to prepare for the information and use of the President and Congress a tentative code of laws providing for the location, development and disposition of minerals lands and mining rights in the lands of the United States, including Alaska, as in the opinion of the commission are best adapted to existing conditions and will correct defects or supply deficiencies in existing general mining laws. The commission shall hold public hearings in the principal mining centers in the western United States and Alaska; invite and receive suggestions and opinions bearing upon or relating to existing mining laws or desirable

amendments thereof; and may also consider the laws and experience of other countries with respect to disposition and development of mines and minerals. Within one year after the passage of this act, at which time the commission shall expire, it shall submit to the President full report as to its operations, conclusions and recommendations, including in or transmitting with the report a tentative code of mineral laws, and within 30 days from receipt thereof the President shall transmit the report to Congress with his recommendations. Each commissioner shall receive a salary of $500 per month. For the payment of these salaries and the expenses of the commission, $25,000 is appropriated.

New Construction by U. S. Steel Corporation

Construction on the new steel plant at Duluth, Minn., and the connecting railroad to serve the same, proceeded during 1913, additional expenditures having been made at a cost of $5,912,027. It is expected this plant will be completed for operation in the spring of 1915. The plant will comprise two blast furnaces, 10 openhearth furnaces, one 40-in. blooming mill, one combination 28-in. and 18-in. rail and shape mill, one combination 16-in., 12-in. and 8-in. merchant mill, and a by-product coke plant of 90 ovens, together with the necessary complement of auxiliary departments, such as power plants, pumping stations, machine and other shops. There has been laid out adjacent to the plant a subdivision on which work has been commenced in the building of houses for use by employees. The total expenditures made to the close of 1913 for acquirement of the land for site of steel plant and subdivision, for construction of plant, development of subdivision and building of the railroad, was $13,445,648, all of which has to date been advanced from the current assets of the Corporation. There is under consideration a suggestion to reimburse the treasury for a substantial part of this outlay, and additional outlays yet to be made in connection with the work, through an issue and sale of bonds secured on the property. Work was commenced during the year on the construction of an additional cement plant located adjacent to the new steel plant at Duluth, Minn. This cement plant will have an annual capacity of 1,400,000 bbl. It is being constructed by the Universal Portland Cement Co., a subsidiary company. The plant will utilize in the manufacture of cement blast-furnace slag from the steel plant. It will probably be completed for operation in 1915.

The unfinished new rod mill and wire plant of the American Steel & Wire Co., located at Fairfield, a suburb of Birmingham, Ala., was completed during the year and went into operation in February, 1914. The plant has a capacity of 400 tons per day of finished wire products of various kinds. Large layouts were made in the construction at the Edgar Thomson works of Carnegie Steel Co. of a new 14-furnace openhearth plant, and for the relocation, rebuilding and enlargement of the blooming mill and the No. 2 rail mill. These mills will produce a greater diversity of product and wil otherwise be of advantage. A considerable part of this work was completed and in operation at the close of the year. At Duquesne works of Carnegie Steel Co., a new 10-in. electrically driven bar mill was installed; and at McCutcheon works a new steel hoop mill was completed and placed in operation. At the South Works of the Illinois Steel Co. two addition openhearth furnaces and a new 300-ton hot-metal mixer were installed; and at Gary, Ind., works, a new 36-in. reversing slabbing mill was completed and placed in operation.

The various subsidiary railway companies during the year acquired by purchase or construction 58 additional locomotives and 3578 cars of various kinds. They also acquired on replacement account 12 locomotives and 293 cars. There were placed in commission on the Great Lakes during the year three new 12,000-ton ore-carrying steamers; and one additional freight steamer was purchased for service in the export trade. In the construction of a new steel ore dock of 384 pockets at Duluth, Minn., the Duluth, Missabee & Northern Railway Co. expended during the year $1,516,830. This dock will be completed in 1914 and its total cost will be about $3,000,000.

Visit to an 18th Century Mine

In a curious old book of travels, under the date June 7, 1774, is given the following account of a visit to the old iron mines of Dannemora, Sweden. It is interesting to note that these mines are still producing a fine quality of ore.

June 7, 1774.—We lay at a very pretty village called Ostarby, on Monday night, and went about three miles the next morning to see the mines of Dannemora. They are celebrated for producing the finest iron ore in Europe, the iron of which is exported into every country, and constitutes one of the most important sources of the national wealth and royal revenue. The ore is not dug, as in the mines of tin or coal, which we have in England, but is torn up by powder. This operation is performed every day at noon, and is one of the most tremendous and awful it is possible to conceive.

We arrived at the mouth of the great mine, which is near half an English mile in circumference, in time to be present at it. Soon after 12 the first explosion began. I cannot compare it to anything so aptly as subterraneous thunder, or rather volleys of artillery discharged underground. The stones are thrown up by the violence of the powder to a vast height above the surface of the mine, and the concussion is so great as to shake the surrounding earth or rock on every side. I felt a pleasure connected with terror as I hung over this vast and giddy hollow, to the bottom of which the eye attempts in vain to penetrate.

As soon as the explosions were finished, I determined, however, to descend into the mine. There is no way to do this but in a large, deep bucket, capable of containing three persons, and fastened by chains to a rope. The inspector, at whose house I had slept the preceding night, took no little pains to dissuade me from the resolution, and assured me, not only that the rope or chains sometimes broke, but that the snow and ice which lodged on the sides of the mine frequently tumbled in and destroyed the workmen; nor could he warrant my absolute security from one or both of these accidents. Finding, however, that I was deaf to all his remonstrations, he provided me a clean bucket, and put two men in to accompany me.

Note—Reprinted from the "New York Times Annalist," Mar. 9, 1913.

The gentleman who traveled with me had already been in the mines of Fahlun in Dalecarlia, where there is a ladder for that purpose, and he did not choose to see a second mine after having once gratified his curiosity. I wrapped myself, therefore, in my greatcoat and stepped into the bucket. The two men followed, and we were let down.

I am not ashamed to own that when I found myself thus suspended between heaven and earth by a rope, and looked down into the deep and dark abyss below me, to which I could see no termination, I shuddered with apprehension, and half repented my curiosity. This was, however, only a momentary sensation, and before I had descended a hundred feet I looked around on the scene with very tolerable composure. It was near nine minutes before I reached the bottom, it being 80 fathoms, or 480 feet.

The view of the mine when I set my foot to the earth was awful and sublime in the highest degree; whether terror or pleasure formed the predominant feeling as I looked at it is hard to say. The light of the day was very faintly admitted into these subterranean caverns. In many places it was absolutely lost, and flambeaux supplied its place. I saw beams of wood across some parts from one side of the rock to the other, where miners sat employed in boring holes for the admission of powder with as much unconcern as I could have felt in any employment, though the least dizziness, or even a failure in preserving their equilibrium, must have made them lose their feet and dashed them to pieces against the rugged surface of the rock beneath. The fragments torn up by the explosion previous to my descent lay in vast heaps on all sides, and the whole scene was calculated to inspire a gloomy admiration in the beholder.

A confinement for life in these horrible iron dungeons must surely, of all punishments which human subtlety has devised, be one of the most terrible. I remained three-quarters of an hour in these gloomy and frightful caverns, and traversed every part of them which was accessible, conducted by my guides. The weather was very warm, but here the ice covered the whole surface of the ground, and I found myself surrounded with the colds of the most rigorous winter, amid darkness and caves of iron. In one of these, which ran a considerable way under the rock, were eight wretches warming themselves around a charcoal fire, and eating the little scanty subsistence produced from their miserable occupation. They arose with surprise at seeing so unexpected a guest among them, and I was not a little pleased to dry my feet, which were wet with treading on the melted ice, at their fire. There are no less than 1300 of these men constantly employed in the mines, and their pay is only a copper dollar, or 3d. English, a day. These mines were first opened about 1580, under the reign of John III, but have only been constantly worked since Christina's time.

After having gratified my curiosity with a full view of these subterranean apartments, I made the signal for being drawn up, and can most seriously assure you I felt so little terror while reascending, compared with that of being let down, that I am convinced in five or six times more I should have been perfectly indifferent to it.

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An Estimate of the Quantity of Manganese Ore Used in 1913, puts the total at 2,000,000 tons, of which Russia furnished close to 1,000,000 tons and India 810,000 tons. The Indian production is increasing, while that of Russia is about stationary.

Tariff Regulations on Zinc in Ores

WASHINGTON CORRESPONDENCE

New customs regulations relating to the appraisement of zinc contained in zinc-bearing ores have been issued by the Treasury Department. Assistant Secretary Hamlin announced the new rules in a letter to the Collector at Denver, as follows:

The Department refers to your letter of Oct. 22 last relative to the appraisement of zinc contained in zinc-bearing ores. It appears that there are several forms of zinc ore: (1) Straight zinc ore containing no other valuable metal than zinc; (2) zinc-bearing ore containing lead or other metals, but in such small quantities as not to be commercially recoverable; (3) zinc-bearing ore containing other valuable metals, both the zinc and the other metals being commercially recoverable at a profit; (4) zinc-bearing ore containing other metals, but the zinc not commercially recoverable, and in some instances a detriment, and the ore less valuable because of the presence of the zinc.

(1) In the first two instances, if there is an open market value of the ore in the country from which reported, the price at which the ore is sold represents the value of the zinc contained therein, and is the value at which the zinc should be appraised. If such ores are not freely sold in the markets of exportation recourse must be had to paragraph L and the value of the zinc determined, according to the percentage of zinc, based on the value of spelter in the United States, making due allowance for cost of transportation, duty, profit, smelting and overhead expense.

(2) Under the conditions stated in paragraph 3, when ores contain zinc and other valuable metals, if the price at which the ore is sold does not represent either the price of the zinc or other metals, there is no market value for the zinc contained in the ore in the country from which exported. Recourse must, therefore, be had to paragraph L and the zinc contents appraised at the cost of the spelter in the United States, making allowance for the cost of transportation, duty, profit, smelting and overhead expenses.

(3) When the zinc in an ore is not commercially recoverable, or is a detriment in the smelting of other metals, the Department is of the opinion that such zinc is of no commercial value and that no duty accrues thereon.

It appears that most of the zinc ores are sold subject to assay and the price based on the amount of zinc contained therein; that at the time of shipment neither the purchaser nor the seller can state the exact amount to be paid for the particular shipment, and that it is impracticable, if not impossible, for the importer to state in the invoice and entry the exact value of the shipment. In such cases the Department is of the opinion that at the time of entry the importer should state the terms of his contract of purchase and the basis of payment, and that the entered value should be computed upon the basis of such contract, after the assayer has determined the quantity of zinc in the importation, and that unless the appraiser advances the unit of price the appraised value should not be considered as exceeding the entered value, although the total value of the invoice may exceed the total value as estimated by the appraiser.

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Legal Principles Governing Mining Claims

BY A. L. H. STREET

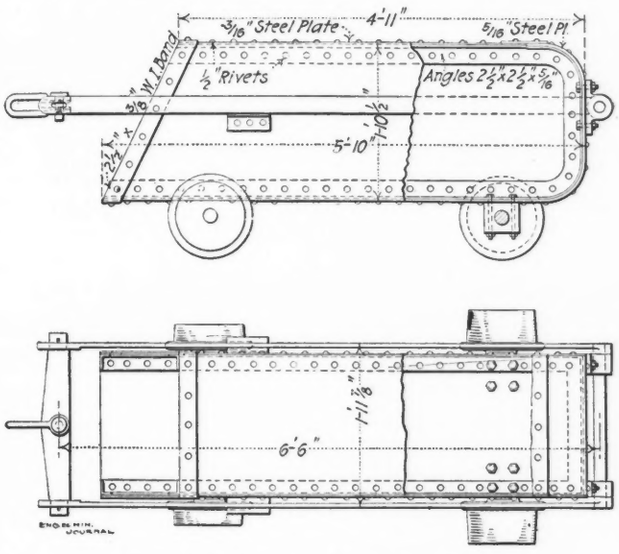
In the case of Round Mountain Mining Co. vs. Round Mountain Sphinx Mining Co., 138 *Pacific Reporter* 71, the Nevada Supreme Court recently announced these rules as being applicable to contests over mining claims:

A mining patent cannot be attacked on the ground of invalidity in a collateral suit, by one who did not oppose its issuance when application therefor was pending. Rules of the United States General Land Office are controlling in the acquisition of title to mining claims, so far as they do not conflict with law. Mere posting of a mining location without discovery does not invalidate a subsequent location based on a valid discovery.

Details of Practical Mining

Light Skip for 65° Incline

The accompanying drawing represents a ¾-ton skip designed for a Mexican mine. The rounded bottom is more common on vertical than inclined skips. The extremely small cross-section, 1 ft. 10 in. by 1 ft. 11⅞ in., is noteworthy. The gage of track is 2 ft., the wheels are keyed to the 2-in. axles which revolve in hardwood boxes.



SMALL-CAPACITY INCLINED SKIP

Drill Hole Samples in Raising

BY A. W. NEWBERRY*

The nature of the orebodies at the Golden Cross mine, Imperial County, Calif., is such that they are best explored by raises driven perpendicular to the dip. These crossent raises, as they are locally known, are inclined at an angle of from 55° to 70° from the horizontal. The cuttings from two drill holes, one on each side of such a raise, will give a comparatively accurate sample of the ground to be broken, in most cases about 4 ft. The cuttings from the first two holes drilled, preferably the corner holes nearest the foot wall of the raise, are accordingly saved by the driller, combined, sacked and tagged with the number of the working face and the date. These samples reach the assay office within three hours from the time that the shift goes on, and the returns are in the hands of the foreman at the beginning of the next day's work.

The plan outlined above may be carried still further in case two shifts are worked. The drilling of an 8-ft. upper presents no special difficulty, although the breaking of an 8-ft. round in a 4x6-ft. raise is quite another thing. After the day-shift driller has sacked the sample of his first 4 ft., he cleans the two drill holes with a wire brush, and with longer steels, cuts a second sample, beginning at the point where the first terminated. Before loading, the upper halves of the two drill holes in question are tamped or plugged and so utilized for breaking ground on the night shift. In this way, results are always on file at the mine office before the broken rock leaves the chute, and a comprehensive assay chart of the raise is obtained.

On account of the spotty condition of the ore, it is not always possible to get consistent checks between drill hole and groove sampling in any one working for any distance. The same is true of two groove samples on opposite sides of a 4x6-ft. raise and also of groove and car samples, so that the discrepancy is not an argument against the accuracy of the drill-hole sampling.

The set of assays in the accompanying table, however, shows as close an agreement as is generally obtained in practice.

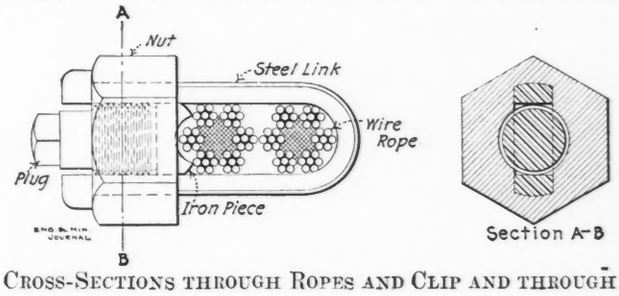
RESULTS OF RAISE SAMPLING BY DRILL-HOLE, GROOVE AND CAR

Date	Drill-Hole Samples Position	Au		Groove Samples Position	Au		Car Samples Au
Dec. 14	Rail +54-57.5 ft.	$1.00					
15	57-61 ft.	0.80					
16	60.5-64 ft.	4.60	6.5 ft. @ $8.90				
17	63.5-67 ft.	13.20		Rail −60-65 ft.	$2.40	7.2 ft. @ $5.64	
18	66.5-70 ft.	3.00		65-67.2 ft.	13.00		$2.00
19	69-73 ft.	1.60		67.2-68 ft.	1.60	(Gouge)	4.80
				68-70 ft.	0.80		1.60

*Mining engineer, 321 Story Bldg., Los Angeles, Calif.

Single-Screw Wire-Rope Clip

The illustration shows a new form of clip for fastening wire ropes together. It consists of a steel link, made flat as shown in the section. The sides of this link fit in two grooves or channels cut in the inside of a nut. The inside dimension of the link is just sufficient to clear the tops of the threads of a plug which works in the nut. The outer end of this plug is square so that it can be turned by a spanner. Between the plug and the two ropes is a piece of iron grooved slightly on one face, to fit neatly on the rope which comes next to it. The ends



CROSS-SECTIONS THROUGH ROPES AND CLIP AND THROUGH NUT

of the link have wings on them. If it is impossible to pass the ropes through the link when the nut is on, then a special link with long ends instead of the wings can be employed, the ends to be hammered back when in position on the ropes.

Fishing for a Lost Drill Bit

By F. B. Tough*

An interesting fishing job in oil-well drilling came under my observation not long ago in the Coalinga oil field of California. The hole was in 2400-ft. territory and being drilled with a rotary outfit. The plan was to set a string of 10-in. casing at 2000 ft. as a conductor and to change over to cable tools at this depth, setting an 8¼-in. water string and completing the well with a 6⅝-in. oil string.

On reaching a depth of 1500 ft. the fishtail bit worked loose from the drill collar and was left in the hole. Several unsuccessful attempts were made to recover the bit with various fishing tools. Rather than lose more time and risk a cave-in of the hole it was decided to fire a charge of dynamite on the bit in order to drive it into the side of the hole, thus affording an opportunity to drill past it. Several shots were fired with but temporary success as the bit kept falling back into the hole when the drill stem was pulled out. In all, four shots were fired aggregating 125 lb. of 60% dynamite.

One day the driller found that even with a freshly dressed bit he was unable to advance the hole after reaching bottom. Under the circumstances this was not as surprising as the fact that there was no resistance to the rotation of the drill. After running for a little while the drill stem was withdrawn and a careful investigation of the bit showed no signs of wear except in the crotch of the fishtail where the rough edges were smoothed off by contact with iron. The points were not touched.

The question then arose "In what position is the lost bit to wear the new one in such a manner?" The answer, which proved to be correct, was, upside down. The accompanying photograph shows a fishtail rotary bit in the inverted position and the fishing tool designed to recover a bit lost in this position. The bit in the illustration is worn down so short that it will probably not be used much more if at all.

This fishing tool, like an old-fashioned solid clothes pin, is screwed to the drill stem, usually 4½- or 6-in. pipe. The one moving part of the tool is a slip shown at *A*, which is at the bottom of a sloping groove, extending longitudinally on the inner face of one leg of the clothes pin. The groove deepens toward the top of the tool and extends a little less than half way up the leg. Directly opposite this on the inner face of the other leg is a double row of ¾-in. holes staggered and plugged with cork. The corks project an eighth of an inch when new and give better friction surface than flat steel.

The object in running the "clothes pin" is, of course, to get it over the edge of the upturned fishtail bit. The split of the clothes pin is tapered so that the friction hold is usually sufficient without the slip. As this tool straddles any object, such as a bit, the slip is pushed upward and at the same time backward due to the sloping groove in which it slides. The face of the slip, which will always be in contact with the object, is roughed to about the same mill as a wood rasp, with the teeth pointed upward.

In running this tool, it is set firmly on bottom, pulled up six to 10 ft., rotated a quarter turn and lowered again. This is repeated several times before the drill stem is withdrawn. For fishing jobs of this kind, the "clothes pin" has been found successful. Unfortunately, a lost rotary bit often falls flat across the hole and causes no end of trouble. The lesson already so well learned in other branches of mining, that where machinery must stand such rough treatment, design it so that the part which breaks first shall be where it can be most easily and cheaply replaced, is being applied to drilling. In the case of the rotary-drill stem this is now being done by a massive steel drill collar three or four feet long immediately over the bit and for 300 or 400 ft. above this the drill stem is made of heavier pipe than the upper part. Then when a break occurs, it is nearly always 300 to 400 ft. off bottom that the stem twists off, when it is usually but a small job with an "overshot" to recover the lost pipe.

Instrument Used for Extracting a Reversed Drill Bit

*Mining engineer, Maricopa, Calif.

Electrically Operated Mine Door

A motor-controlled mine door is described in *Coal Age*, Feb. 21, 1914. The operating mechanism rests on a piece of sheet iron fastened to two wrought-iron pipes 6 in. in diameter, standing upright about 4 or 5 ft. to one side of the track. These pipes also act as a roof support. The apparatus consists of two single-knife switches, set in the drift at 300 ft. each side of the door, a 2½-hp. cable-reel vertical motor *A*, connected by a set of bevel gears or two horizontal cast-iron cylindrical drums *B*, a rheostat *C*, an electro-magnet *D*, and a 15-lb. counter-balance weight *E*. The switches, motor, rheostat and magnet are all connected in series, and the whole connected to the trolley circuit.

Two lamps are hung from the back on each side of the door, so that when it is closed, only two lights can be seen, but when it is open all four lights are plainly visible and the motorman can tell from a distance whether the door is open or shut.

On approaching the closed door, the motorman throws in the switch, which is within easy reach, and the motor begins revolving. A 4½-in. spur gear *F*, on the end of the armature shaft drives an 11-in. wheel *G*, which, in turn, through a set of 4-in. bevels causes the two cylindrical drums, about 3 in. diameter, to rotate. On one of these drums is wound a rope which pulls the door open, while the other drum takes up a rope attached to the weight. The weight acts as a retarder in opening the door and as an accelerator when the door is released to swing shut.

Attached to a third wrought-iron pipe, close by the other two, is an electro-magnet about level with the top of the door. If the current for any reason ceases flowing while the train is going through the doorway, this magnet releases a hook *J*, which catches the top of the door and holds it until the current comes on again.

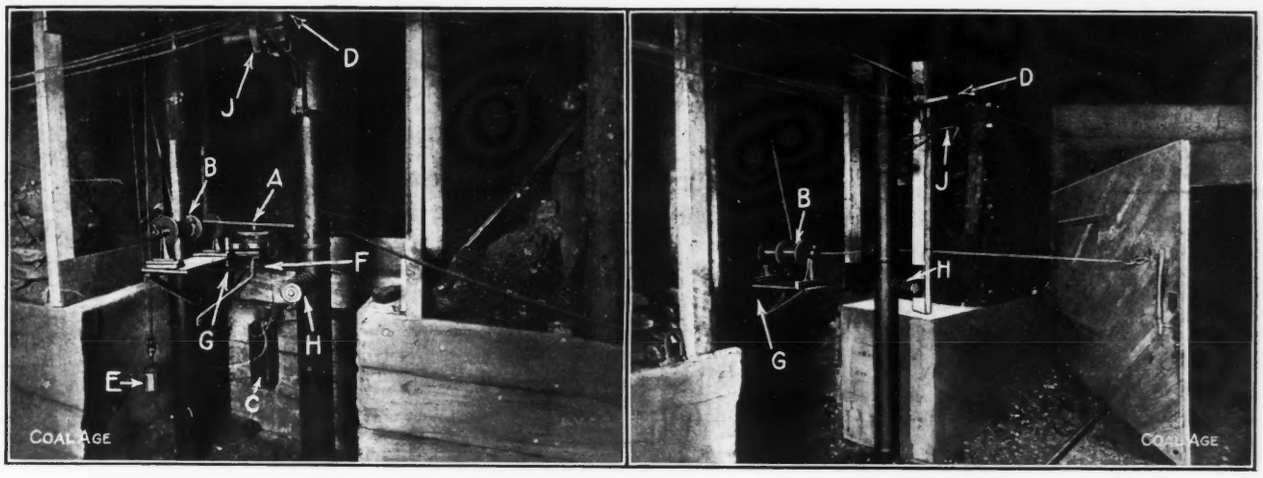
On this third post about three feet up from the bottom of the door is a heavy spring buffer *H*, which acts as a cushion when the door strikes it in opening, and which assists in closing the door when the current is cut off. On reaching the second switch the motorman pulls it open; thus shutting off the current from the motor and releasing the door. The operation is repeated in the same manner on the return trip. There is only one electric locomotive on the road, making on an average six trips a day in each direction.

The door is of yellow pine, 7 ft. high by 8 ft. wide. An 8-amp. 250-volt direct-current flows through the motor. The motor is designed for continuous service without burning out.

The depreciation and maintenance cost of this entire apparatus is about 1c. per day, and the cost of current consumed by the motor is not over 9c. per day.

Problem of Replacing Hand Tramming with Electric*

In many mines where large tonnages are known and proper provisions can be made, the problems of electric traction by trolley locomotives are not much different from those of surface plants. Track gage, curve radii and clearances both vertical and horizontal, can be made to suit traffic conditions. It is more difficult to install electric traction in mines which were started with hand tramming and where no consideration was given to the possibility of mechanical traction being used.



Arrangement of Motor, Drums and Catch for Opening and Closing Door by Electricity

With the gage of track usually 18 or 20 in., the weight limit of locomotives obtainable from manufacturers in this country varies from 3 to 6 tons. The full-load speed varies from 4½ to 6 miles per hr. These locomotives, being made to run on small-radius curves, have a short wheel base and a long overhang from axle to coupling, which necessitates a coupling with a good deal of lateral motion to avoid derailing the cars on sharp curves, especially if couplings are of the standard railroad automatic type.

Although three-ton locomotives will run on 12- or 16-lb. rails, it has been found more satisfactory to use 25-lb. rails, as the track keeps in much better shape, it is easier to maintain the bonding in good order, and fewer derailments from dirt on the track occur with the larger rails. Where six-ton locomotives are used the 25-lb. rails are satisfactory, but 40-lb. rails have proved cheaper where the traffic is heavy and the ground is soft, as the track maintenance thus is considerably lower. The loco-

*Note—An abstract from a paper by C. Legrand, A. I. M. E., "Bull.," February, 1914.

motives will run on 15-ft. radius curves, but on through runs it is advisable not to go below a 40-ft. radius.

The voltage used should not exceed 250 to 275 volts, and the trolley wire should be protected, to prevent accidental contacts, in front of chutes and at all points where it is low. With the air lacking somewhat in oxygen and the heat and high humidity prevalent in many mines, this voltage, which is considered perfectly safe, has proved fatal in several instances and in such mines it is advisable to have a pulmotor available and men trained to use it in case of accident. The trolley wire should be protected from dripping water and if the water is acid it must be protected; instances are known where a small drip has cut a No. 00 trolley wire in less than three weeks.

The track bonding should be kept in good shape. This is difficult, as most of the trackmen in the mines do not realize its importance. A badly bonded track will increase the repairs of motors considerably, as in passing from a dead rail to a live one the sudden rush of current is liable to form an arc across the motor commutator or from the commutator to the ground.

If the locomotive is not mounted on springs it has been found advisable to put the resistance grids on springs, with flexible leads to the controller, as on small locomotives the cast-metal grids are light and very easily broken.

In a mine laid out for hand tramming the grade is generally made in favor of the loaded cars so that the load is fairly uniform going down with the loaded cars and coming up with the empty cars. This gives ideal conditions for a full load on locomotives at all times; but the motors and electric locomotives are seldom made so that the locomotive can deliver its full tractive effort continuously and this ideal operating condition leads to overheating of the motors and heavy repairs, unless the number of cars attached to the locomotive is kept down to the maximum that the motors can pull without overheating. This is difficult in practice, as it seems against human nature to run a locomotive of any kind with a load that does not slip the driving wheels when starting or at every point in the track where conditions are a little unfavorable. The difficulty of getting motors of sufficient size in the small space available with 20-in. gage has obliged us in one or two instances where traffic is heavy and continuous to build our own locomotives, putting the motors above the wheels and gearing to the axles outside of the wheels. Even with this design the necessary clearance in the drifts limits the weight of locomotives to about seven tons.

At the mines of the Copper Queen company, in Bisbee, the power used on trolley locomotives, measured at direct-current switchboard in power station, for the year 1912 amounted to 875 watt-hours per useful ton-mile. This amount, however, includes a few lights which are connected to the trolley circuit and gives too high a figure for the locomotives alone. It applies to cars with roller bearings, about one-half of the tonnage being carried in cars of two tons capacity and the other half in cars of one ton capacity. The conditions of the cars and track have quite an important bearing on power required per ton-mile, although no accurate figures are at hand. A rough idea can be formed from the fact that on a certain track in the mine of the Moctezuma Copper Co. one three-ton locomotive cannot pull more than five cars of 20 cu.ft. capacity, equipped with regular Anaconda axles, without slipping the wheels, while the same locomotive pulls six cars of 22 cu.ft., capacity equipped with roller-bearing axles.

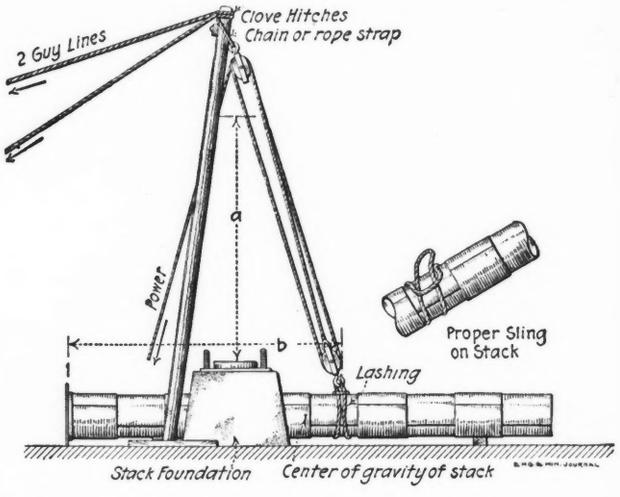
For the year 1912 the cost of various items in cents per useful ton-mile at Bisbee for a total of 408,000 ton-miles was as follows: Locomotive maintenance, 2.95c.; car maintenance, 1.64c.; track maintenance, 5.24c.; trolley maintenance, 3.60c.; power, 1.64c.

Locomotive maintenance includes all electrical and mechanical repairs and replacements on locomotives, as well as lubricating oil and supplies. Car maintenance includes all repairs, oil and supplies on cars. Track maintenance includes all track repairs and replacements, bonding, grading and realignment. Trolley maintenance includes all trolley-wire repairs and replacements, and repairs to protective trough around trolley wire. Track and trolley maintenance are heavy, due to the shifting ground. The cost of power (1.1 kw.-hr. per ton-mile) is taken at the high-tension switchboard and includes the loss in transforming the alternating current into direct current.

Handling Stack with a Gin Pole

By A. Livingstone Oke

The proper method of placing stacks or columns on their foundations, using a single gin pole is shown herewith. While not new, it is probably not known to all.



Rigging of Gin Pole and Tackle for Setting Steel Stack

There should be two guy ropes at the back, secured firmly, so that the pole has a good cant toward the pull of the tackle. The lashing must be placed on the stack as far above the center of gravity as the available height of the gin-pole allows, the distance *a* always being kept greater than *b*, after making due allowance for the length taken up by the tackle itself. The power may be applied from a windlass or by direct pull, depending on the weight to be handled. The more nearly vertical the pull the better, a snatch-block being necessary if the windlass is not directly below the lifting tackle.

Details of Milling and Smelting

Converting Low-Grade Matte at Kennett, Calif.

By J. H. Kervin*

Converting practice at Kennett is chiefly of interest on account of the low grade of the matte converted into blister copper in one operation. The grade of matte ranges from 13 to 20%, averaging about 17% Cu; the amount of such matte treated is from 170 to 200 tons per day.

The blister copper produced per lining ranges from 20 to 27 tons, depending on the grade of matte.

This practice would not in general be recommended; the conditions rendering it advisable at Kennett are the desirability of treating the maximum quantity of sulphide ore and the limitation of the amount of hot gases that can be cooled and filtered through the baghouse equipment. The converter plant is equipped with two stands and eight barrel shells, each 96x150 in.; blast is supplied at 13-lb. pressure by a 12,000-cu.ft. Nordberg blowing engine.

The converters are lined on one 8-hr. shift, the number of converters lined per week ranging from seven to nine. The drying is also done on one shift, using an average of 48 gal. of fuel oil per converter dried. The quartz used for lining is obtained principally from Nevada, and averages about 22 tons per converter. The percentage of clay used as a binder ranges from 0 to 10%, depending on the Al_2O_3 content in the ores used. The analyses of the siliceous ores and clay used are about as follows: Ore, Cu, 4%; SiO_2, 69.2; Al_2O_3, 8.9; Fe, 4.2; CaO, 0.3; clay, SiO_2, 59%; Al_2O_3, 27; Fe, 2.1; CaO, 0.2%. The siliceous ores fed through the converter mouth average 39 tons per converter; ores from Idaho, Nevada and local ores are used for this purpose.

The greater portion of the converter slag is poured into the blast-furnace settlers. All thick slag, and slag produced on the final skimming, is poured into a slag-casting machine, from which it is sent to the receiving bins to be re-smelted in the blast furnaces. The analysis of the converter slag is as follows: Au, 0.01 oz.; Ag, 1.09 oz.; Cu, 1.26%; SiO_2, 31.3; Fe, 43; CaO, 1.0; Zn, 2.7; S, 1.5; Al_2O_3, 4.2 per cent.

It is likely that more economical converting could be done by the use of a basic lining. Experiments have been conducted along this line, indicating that in the treatment of such low-grade matte it was difficult to hold the temperature of the converter down to the point at which the lining would not be attacked, without at the same time reducing the daily capacity of the converter below the point necessary to handle the existing tonnage of matte. The savings to be expected by basic converting did not seem sufficient to justify the installation of a third converter stand.

*Smelter superintendent, Mammoth Copper Mining Co., Kennett, Calif.

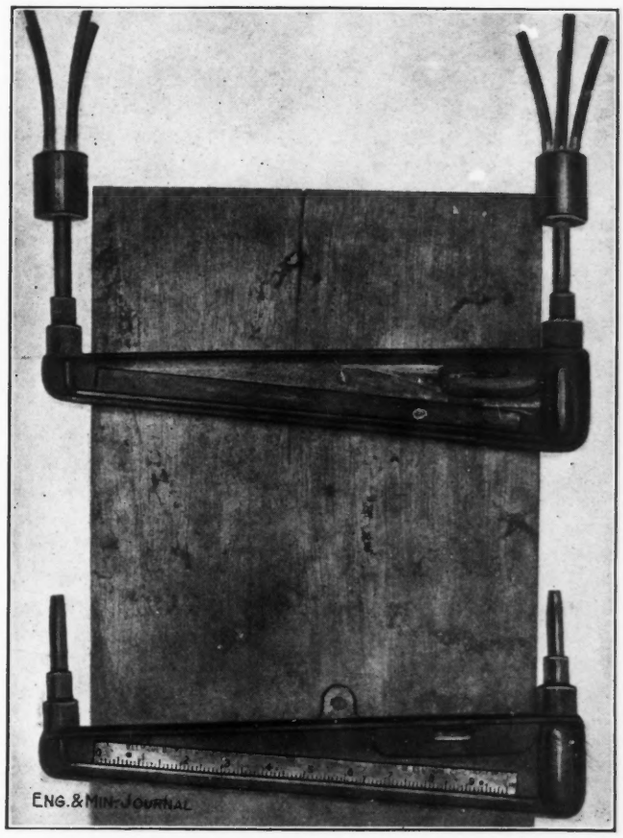
Automatic Averaging Device for Differential Draft Gages

By Arthur T. Ward*

In determining the velocities of furnace or converter-flue gases, it is customary to use pitot tubes in conjunction with some form of a draft gage (such as the differential gage manufactured by Lewis M. Ellison, of Chicago); the velocity head, measured as read, in inches of water, is substituted in the well known hydraulic formula

$$V = \sqrt{2gh} \qquad (1)$$

and the velocity calculated. When a number of readings



Averaging Device for Pitot Tube Work

of h are taken in a flue where the velocity varies considerably, the average velocity is calculated by means of the following formula:

$$average\ V = \sqrt{2g} \times average\ \sqrt{h} \qquad (2)$$

account being taken, of course, of the fact that h represents a column of gas.

In any flue or stack through which gases are passing, it is a well known fact that the gases at the center have

*Experimental chemist, U. S. Metals Refining Co., Chrome, N. J.

the highest velocity, while those at the sides have the least, the retardation being due to friction. If a set of pitot tubes be inserted at any one point in the section of the flue, the velocity head as measured by the gage will be correct for that point only, and approximately so for a series of points in the section equidistant from the sides. As the center has the highest velocity, one method of determining the average for the flue is to place the pair of tubes at that point and to use an arbitrary factor, determined by experiment. Results secured in this way are questionable as to accuracy, and the following method is preferable:

In the second method, the flue or stack area is divided into equal concentric areas; each area having its own set of pitot tubes, so placed as to secure an average reading for that area—the middle point is the one generally used in annular subdivisions. The average velocity is then calculated on the substitution in the formula (2) of the average value of the square roots of the gage readings.

Several short cuts, for eliminating much of the arithmetical work connected with determinations of this kind have been suggested and used. G. W. Goodale and J. H. Klepinger, in a paper on "The Great Falls Flue System and Chimney," presented before the Butte meeting of the American Institute of Mining Engineers, describe and illustrate what they have termed an "automatic averaging manometer." This manometer, or gage, automatically averages the several readings which otherwise would have been secured were separate gages used, but as stated by the authors, "It is defective in that the velocity head which it indicates is the arithmetical average of velocity heads at the several points of the pitot tube, while the true velocity varies as the square root of the heads."

A much simpler device, or rather set of devices, for automatically securing the required average value of h has been used in a series of experiments recently conducted at Chrome, N. J.; the illustration shows a gage with the devices attached, ready for connection to all the pitot tubes, and a single gage ready for connection to one pair of tubes. One of these automatic averaging devices (two are necessary) consists of a 1⅜-in. brass pipe, 1½ in. long, plugged at both ends. In one plug, four (or as many as are necessary for the pairs of pitot tubes used) holes were bored, into which short sections of ⅛-in. brass tubing were soldered. A ½-in. brass pipe, 2½-in. long threaded at both ends was inserted in a suitable opening in the other plug, one of these devices was then screwed into each of the gage openings. The rubber tubing from the pitot tubes was slipped over the ⅛-in. brass tubing, all from the impact sides being connected at one end of the gage and all from the static at the other. Results secured by the use of a set of these devices on a single gage were compared with those secured through the use of four separate gages, and in every case they agreed closely. As a matter of fact, any error which might be introduced by using one of these "short cuts" would be small in comparison with those errors which are out of the control of the experimenter.

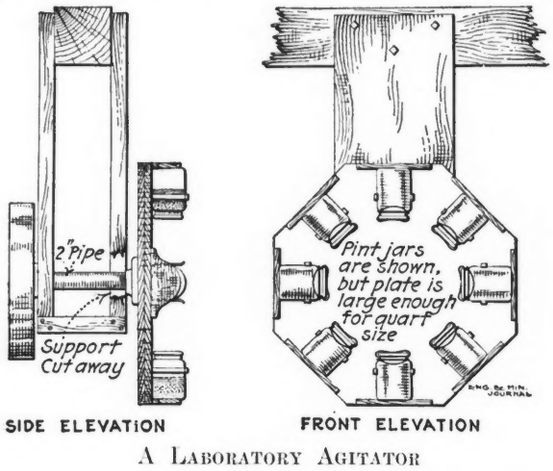
The advantages in using the Chrome averaging devices consist in the facts that no *special* gage is required and that a single gage may be used for practically any number of pairs of pitot tubes; along with these advantages it must be remembered that the number of required observations and the arithmetical part of the calculations are reduced to a minimum, and that only one gage error is introduced into the calculations.

Laboratory Device for Agitation Tests

By R. L. Bartlett*

The device illustrated was constructed at the Coxe mining laboratory, Lehigh University, and has been found very useful in agitating finely ground ore, either with cyanide solution in testing for extraction, or with water and mercury in amalgamation tests. Its simplicity, and the fact that it may be constructed by the mill man, and installed in almost any corner where power from shafting is available, should recommend it to any who desire to do such testing.

As shown, it consists of an octagonal board plate, about 2 ft. in diameter, made of two thicknesses with the grain crosswise. This has an ordinary floor plate fast-



A Laboratory Agitator

ened on one side at the center, and this enables the wooden plate to be screwed on to the end of a 2-in. pipe, on the other end of which a pulley is fastened. The size of this pulley should be such that when belted to the desired shaft, a speed of about 40 to 50 r.p.m. is obtained. The bearings in which the pipe shaft runs are made by boring holes in 2-in. plank, and lubricating with hard grease. In this particular case it was more convenient to hang the apparatus from above, as shown in the sketch, thus no floor space was used. The belting was 2-in. canvas webbing. As this device is capable of much latitude in construction, few dimensions are given, the approximate size of the apparatus only being indicated.

The material to be agitated is put into ordinary spring-top preserve jars, and these are fastened to the wooden plate by wedging the jars between clamps made of strap iron bent as shown in the sketch, and arranged so that the jars to the desired number are set radially on the plate. In this case provision is made for eight jars, though for sake of simplicity only four are shown in the side view.

Carbon Brick Are Obtainable in the sizes 2½x2½x9 in.; and 2¾x4¾x9 in. The latter weigh about 7½ lb. per brick and cost 7½c. per lb., or about 50c. per brick. The standard size of magnesite brick is 2½x4½x9 in., and cost about 15c. per brick. Carbon electrodes cost about 4c. per pound.

*Instructor in ore dressing at Lehigh University, South Bethlehem, Penn.

Company Reports

Arizona Copper Co.

During the year ended Sept. 30, 1913, the Arizona Copper Co., Clifton, Ariz., according to its annual report, made an operating profit of $1,428,780. Including interest and dividend receipts, total profit was $1,782,524, which was reduced to $1,009,180 after payment of interest on terminable debentures, etc. From this surplus dividends amounting to $119,221 were paid on preference shares, leaving a balance of $889,959 from the year's income. This amount added to the surplus forwarded from the previous year made $1,080,776 available for dividends on ordinary shares, and for this purpose, it was voted to absorb $1,015,670 of this surplus.

The final figures show a production of 34,226,000 lb. of copper, a decrease of about 4,000,000 lb. compared with the previous year. This decrease was due to a falling in the grade of the ore mined and delay in getting the new smelting plant up to full capacity. The mines produced 936,903 dry tons of ore averaging 38.76 lb. of copper per ton as indicated by smelting returns. This is a decrease of 2.39 lb. compared with the previous year. About 72% of the ore produced, came from the Longfellow group and 28% from the Metcalf group. About 95% of all the ore mined was concentrating ore and the remainder was direct smelting ore. The ratio of concentration was 7.26:1. The oxide concentrator treated 106,596 dry tons of ore and 85,071 dry tons of its tailings were treated by the leaching plant. Of the total copper produced, about 9.27% came from the oxidized ores. The sulphuric acid plant supplied 3352 tons of acid to the leacher. At No. 6 concentrator Huntington mills are being replaced by Hardinge conical mills, when this change is completed, the plant's capacity will be about 3500 tons a day.

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Brunswick Consolidated Gold Mining Company

The annual report of the Brunswick Gold Mining Co., operating at Grass Valley, Nevada County, Calif., for the year ended Jan. 23, 1914, shows payment of dividend No. 2, $23,717 and total balances to credit of company account and in San Francisco treasury, $54,062. The year was begun with total outstanding balances, $14,752. The bullion production amounted to 11,461 oz. gold, valued at $192,181 and silver valued at $1133; total bullion, $193,314; total value of sulphurets, $15,045; total bullion and sulphurets, $208,355. The tonnage of ore extracted and milled totaled 15,334 tons; total sulphurets produced, 268.653 tons; recovery value per ton in bullion, $12.607; per ton in sulphurets, 98.1c.; total recovery value per ton of ore milled, $13.588. The total cost of mining and milling was $147,684; cost per ton, $9.63. Of the total ore treated, 11,985 tons was, by company account, 3349 tons by tribute. The concentrate was valued at $56 per ton; cost of freight and refining, including loss of 8% in treatment, was $15.976 per ton; net value per ton, $40.024. Detail of costs shows; General, including New York and San Francisco offices, salaries, insurance, taxes, etc., 98c. per ton, total $15,014.30; mining labor, supplies, power, pump, repairs, tribute labor, etc., $5.141 per ton, total $78,850; milling labor, supplies, power, repairs, bullion freight and refining, concentrate treatment, $1.071 per ton. total $16,426, new shaft labor supplies, power, $1.569 per ton, total $24,058; improvements, including new compressor, machine-shop equipment, etc., 75.1c. per ton, total, $11,515, miscellaneous, notes and interest and casualty insurance, 11.8c. per ton, total $1821. Development included drifting, 774 ft., raising, 538 ft., crosscutting 290 ft., new shaft sinking 474 ft.; total, 2076 ft. The report shows a remarkable performance of the 20-stamp mill during the year. The average gold and silver content of the ore milled was $13.92 per ton, from which was recovered 90.6% in bullion and 7% in concentrate, making the total recovery 97.6%, or $13.588 per ton. The average value of tailing run to waste was 32.9c. per ton.

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Homestake Mining Company

Payment of the largest dividends in its history was the biggest achievement of the Homestake Mining Co., operating in South Dakota, as disclosed by the annual report for the year 1914. Cash dividends paid during the year amounted to $2,146,225, and in addition a stock dividend of $3,276,000 was also declared, which represented a capitalization of improvements, property purchase, etc., made in the past few years and paid for out of earnings.

There are broken in the mine but remaining in the stopes, 2,206,671 tons of ore. During the year there was completed 16,313 ft. of drifts and 686 ft. of raises. The depth of the shafts remains the same as was reported last year, viz.: Ellison, 1850 ft.; B. & M., 1550 ft.; Golden Prospect, 1100 ft.; Golden Star, 1400 ft.; Old Brig, 800 ft.; Golden Gate, 800 ft. The property of the company is reported in fine physical condition, everything about it running smoothly, and its prospects for a long and profitable life, bright in the extreme.

During the year there were milled 1,540,961 tons of ore, which yielded bullion of the value of $6,186,651.78, or an average of $4.0148 per ton. Costs were about as follows (the reports does not give unit costs, but goes into a lengthy detail of disbursements that cannot easily be segregated and divided so that an absolute result may be obtained):

Mining	$1.6963
Stamp milling	0.4099
Regrinding	0.0097
Cyaniding	0.1922
General	0.2859
Total	$2.5940

In addition to the expenditures which have been considered in computing the above costs, there was expended

for aid fund, $13,607; benefices, $2433; house, $4846; recreation hall, $102,936, and property purchase, $79,704. The general expenses given above include the items in the report of: Freight on bullion, general expense, hospital, legal, office, survey, taxes and timber lands. In computing the mining and milling costs, reported items of assay office, blacksmith, foundry, machine shop, salary, stable and timber were equally divided between milling and mining.

The balance sheets for the dates Dec. 31, 1912, and Dec. 31, 1913, are as follows:

ASSETS	1912	1913
Mines, hoisting works, stamp mills, regrinding plant, compressor plants, pumping plants, electric lighting plants, timber lands, assay office, buildings, refining plant, machine shop, foundry, water rights franchises, etc.	$21,840,000.00	$25,116,000.00
Balance in banks	1,614,928.58	1,635,502.95
Balance with superintendent	83,050.98	43,431.53
Bullion in transit	273,796.11	276,123.28
	$23,811,775.67	$27,071,057.76
LIABILITIES		
Capital stock:		
Authorized, 220,000 shares, $22,000,000		
Unissued, 1,600 shares, 160,000		
Outstanding	$21,840,000.00	$25,116,000.00
Accounts payable	2,942.00	
Outstanding drafts	492,712.97	520,995.21
Unclaimed dividends	5,660.71	5,814.71
Profit and loss account	1,470,459.99	1,428,247.84
	$23,811,775.67	$27,071,057.76

Officers of the company are: J. B. Haggin, president; F. G. Drum, vice-president; Fred Clark, secretary, and J. B. Haggin, treasurer. The directors are the above, with H. L. Tevis, E. H. Clark, Thomas Turner and Richard Clark. T. J. Grier is superintendent, C. W. Merrill, consulting engineer, and Chambers Kellar, attorney.

Mass Consolidated

The annual report of the Mass Consolidated for 1913 states that receipts amounted to $189,558 and expenditures to $217,564, an excess of $28,006 over receipts. Expenses chargeable to the strike were $40,274. Liabilities over assets amount to $18,658. A summary of operations follows: Rock hoisted, 95,434 tons; rock stamped, 78,250 tons; mineral produced, 1,773,810 lb.; refined copper produced, 1,213,545 lb.; percentage of mineral in rock, 1.13%; percentage of copper in mineral, 68.415%; refined copper per ton of rock stamped, 15.51 lb. The mine was closed down on July 23, on account of the general strike in the Lake Copper district and has remained idle since that date. On Feb. 16, 1914, conditions had improved to such an extent, that the management expected to be able to resume operations within a few days.

Rochester Hills

The first annual report of the Rochester Hills Mining Co., Rochester, Nev., shows that 9165 tons of ore valued at $175,761, or about $19.20 per ton, were shipped during 1913. The ore is hauled by wagon to Limerick Cañon at a cost of $2.50 per ton; from this point the ore is hauled by the Nevada Short Line Ry., a narrow-gage road 4½ miles long, for $1.50 per ton and delivered to the Southern Pacific at Oreana, Nevada.

The present equipment at the mine consists of a 25-hp. Fairbanks-Morse oil engine; duplex air compressor, capacity 240 cu.ft. per min.; six machine drills, Westinghouse generator, capacity 50 lights; and a 6-hp. Fairbanks gasoline hoist. The mine is now 225 ft. below the tunnel level and the following new machinery is being installed; 75-kv.a generator; 50-hp. motor, switches, etc.; nine-drill air compressor; drill sharpener; electric hoist; and two 100-hp. engines. It is stated that this plant will enable the mine to handle from 300 to 500 tons a day. The company operates under a lease.

Allis-Chalmers Manufacturing Co.

The Allis-Chalmers Manufacturing Co. reports a surplus on Dec. 31, 1913, of $755,124, representing profits from the beginning of business on Apr. 16 to Dec. 31, 1913. The unfilled orders on hand at the close of the year amounted to $3,350,000. There was a decided falling off in business after Aug. 1, in sympathy with the general slackening throughout the country, reflected in a large reduction of profits each month since Oct. 1, and as yet there has been no improvement. The directors have voted to defer dividend action "until such time as profits and business prospects will justify the expectation that they can be declared and maintained at a specified rate." The net current assets of the company as of Dec. 31, after deducting proper reserves, amounted to $13,128,196 and the current liabilities of $1,042,501, leaving the net working capital $12,085,695.

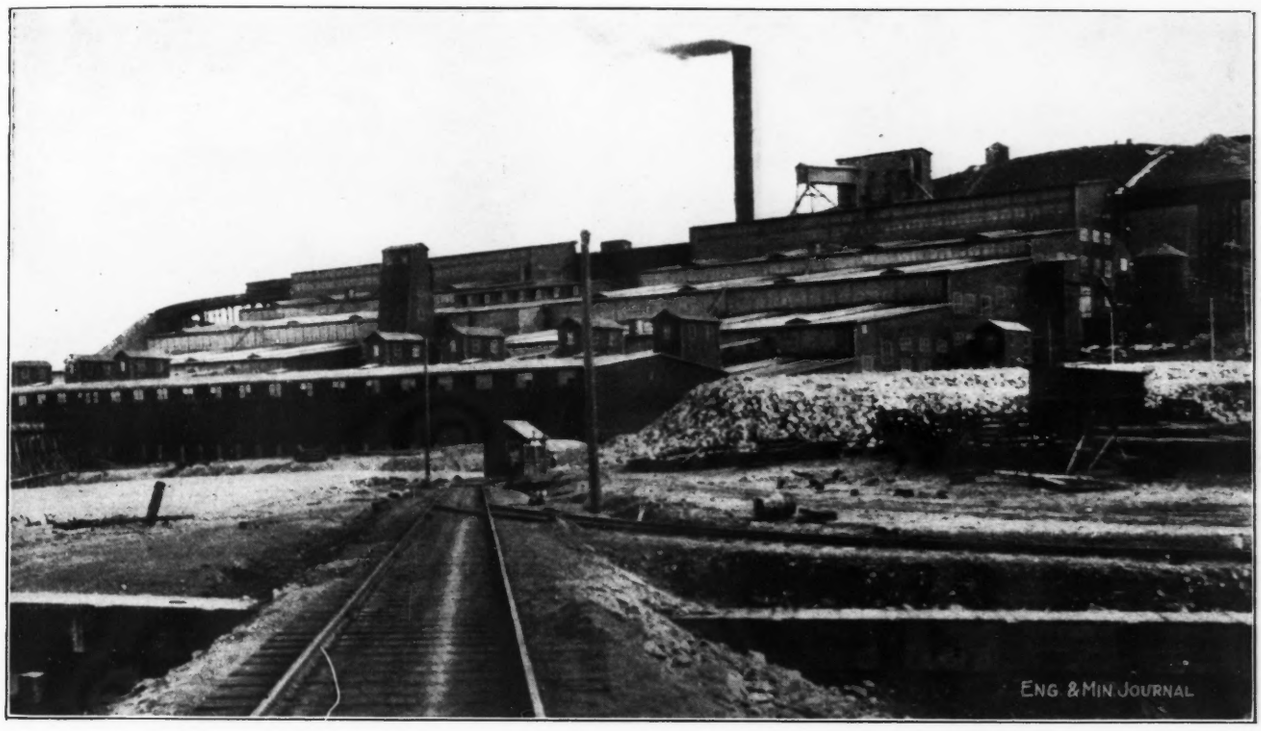
South Lake Mining Co.

According to the annual report of the South Lake Mining Co., Houghton, Mich., its income amounted to $67,177 for 1913, made up of $66,000 from the sale of 10,000 shares of stock and $1177 from interest receipts. Expenditures amounted to $50,457, leaving a net gain of $16,720 in assets. The shaft started in 1912 to open up orebody indicated by diamond drilling, was sunk to a depth of 537 ft. and plats were cut at the 300-, 400- and 500-ft. levels. Three amygdaloid lodes, showing good copper contents, were cut by the shaft. When the 600-ft. level is reached, a southeast crosscut will be run to cut the lodes proved by Nos. 3 to 8 diamond-drill holes. Surplus assets amount to $46,606, of which $39,495 is in cash.

Wettlaufer Lorrain

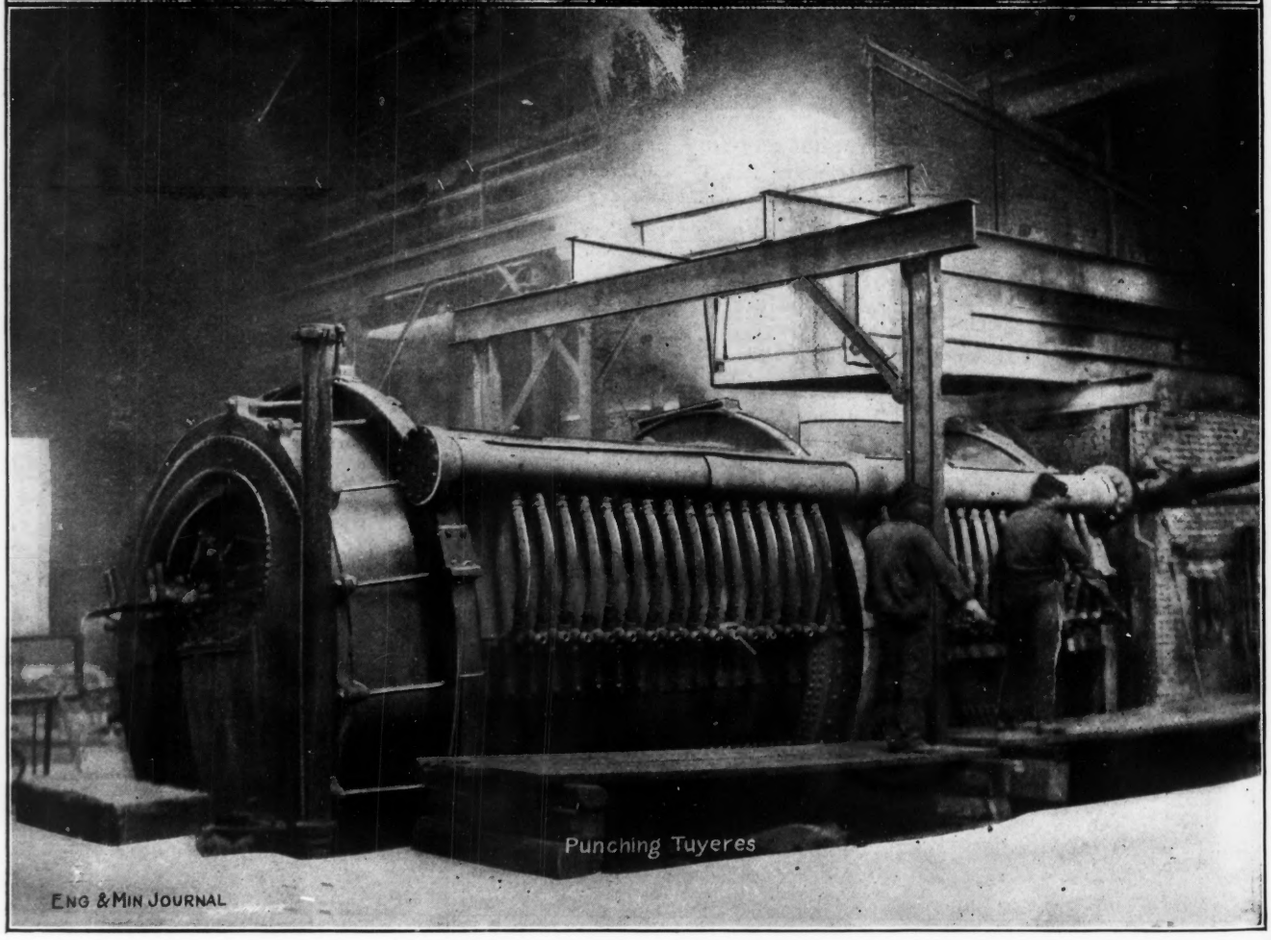
The annual report of the Wettlaufer Lorrain, Silver Mines, Cobalt, Canada, for year ended Dec. 31, 1913, shows a profit of $38,042. On Oct. 31, the directors decided to close down the property on account of disapppointing results of explorations and the depletion of known ore reserves. It is stated that every reasonable development has been carried out and the surface of the property thoroughly trenched without results. Dividends amounting to $141,659 were paid during the year leaving cash and quick assets aggregating $141,920. The larger part of this balance is available for the purchase of other property in the event it is decided to acquire new lands. A profit of $320,248 was reported for 1912 by this company.

Photographs from the Field



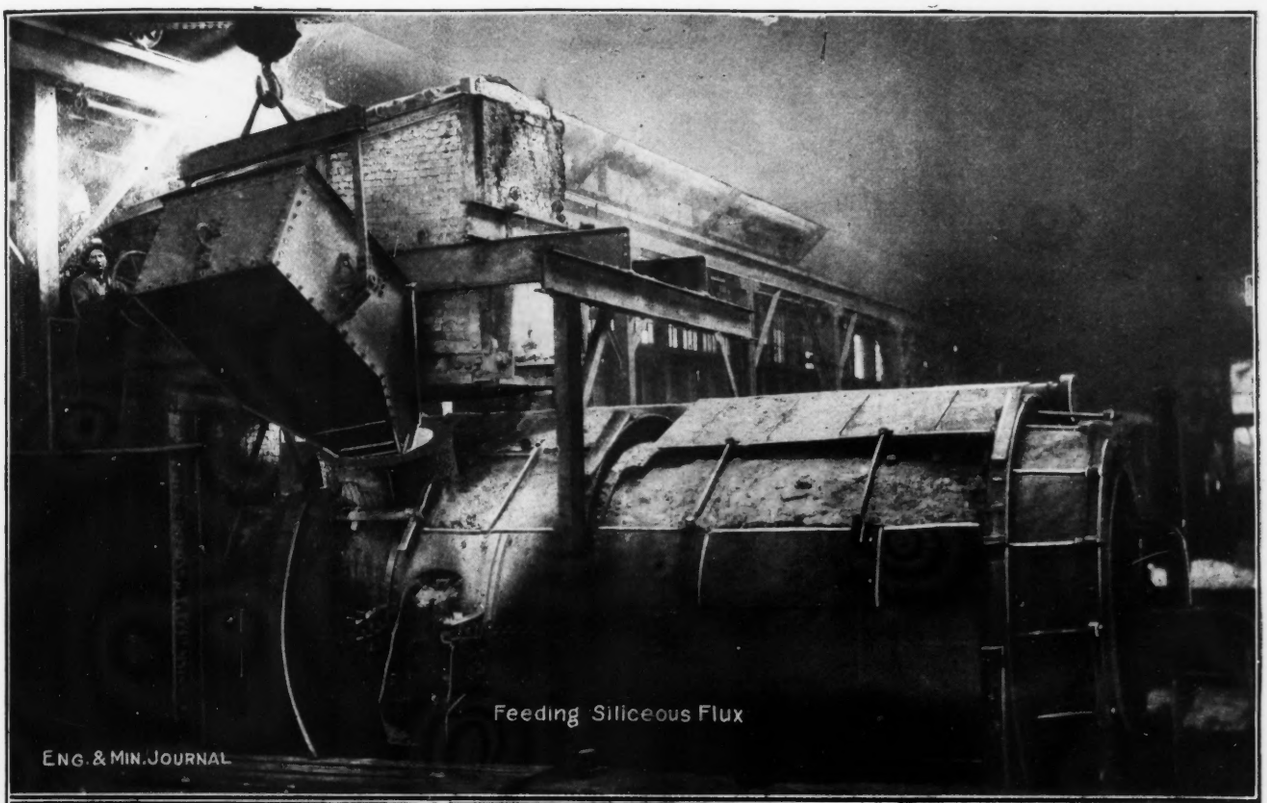
CONCENTRATOR AT THE WASHOE REDUCTION WORKS OF THE ANACONDA COPPER MINING CO.
Capacity of plant is 11,000 tons per day. A new slime round-table plant is now half completed.

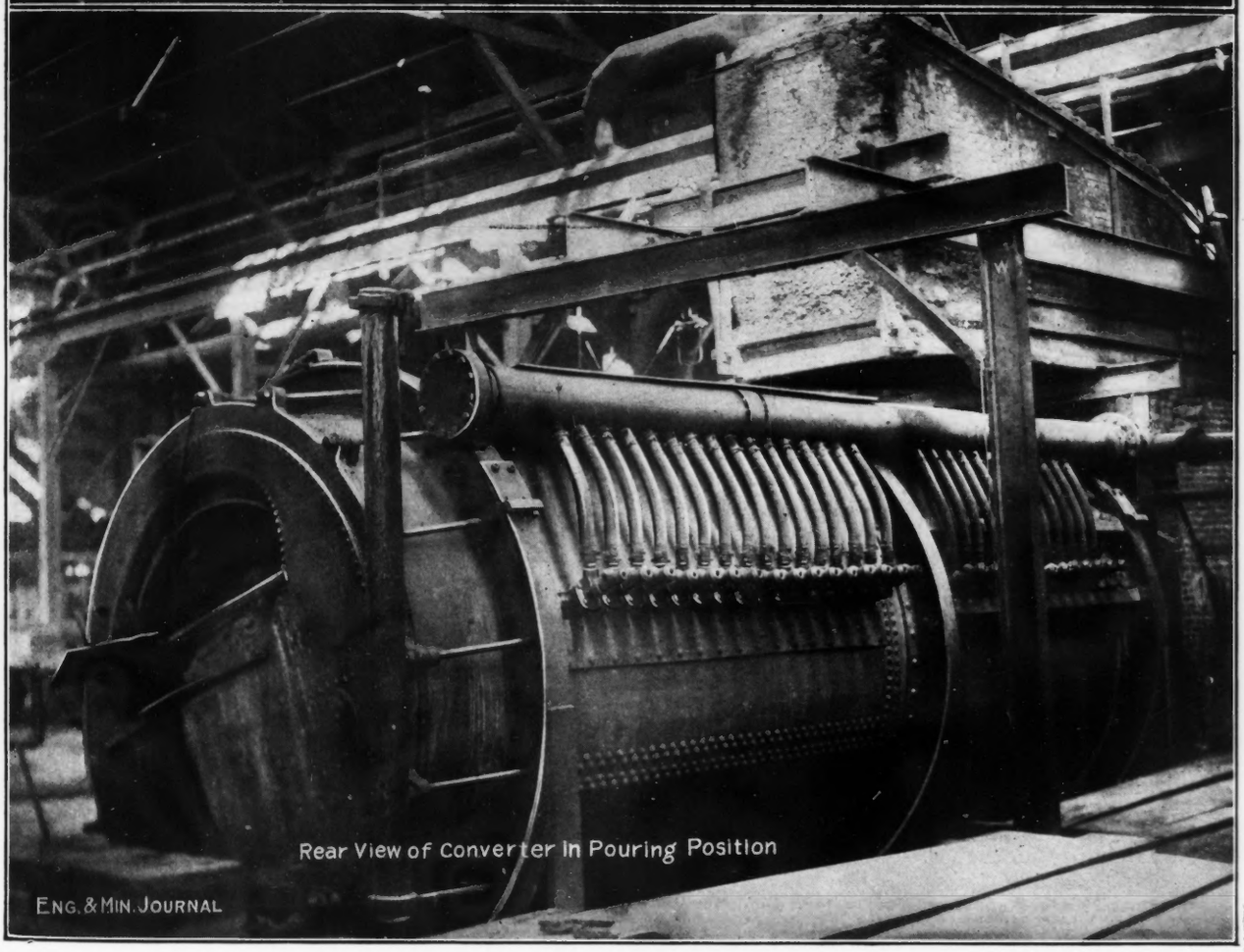
GENERAL VIEW OF THE WASHOE REDUCTION WORKS AT ANACONDA, MONT.
Extensive additions to this plant are now being made.



THE ORIGINAL PIERCE-SMITH CONVERTER AS DEVELOPED AT THE PLANT OF

At this plant the converting of copper matte on a basic or noncorrodible lining was brought





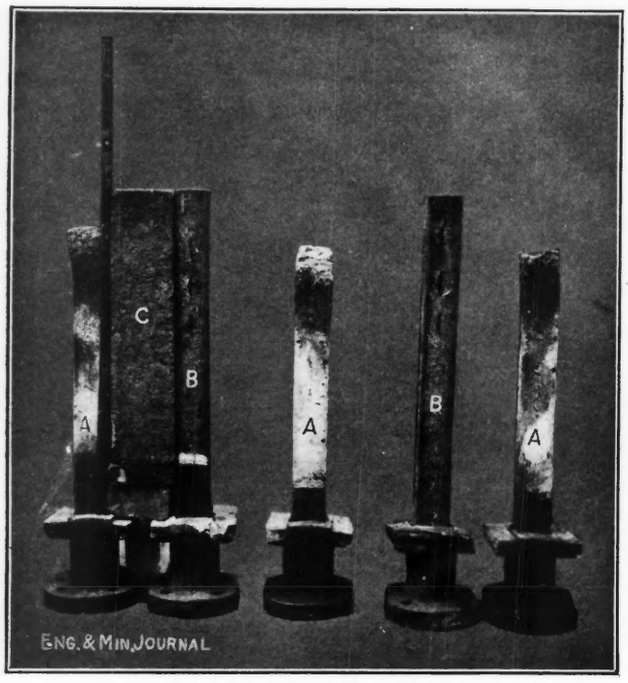
THE BALTIMORE COPPER SMELTING & ROLLING CO., BALTIMORE, MD.

to a commercial success. Since 1910 mattes have not been shipped to this works for treatment.

The Original Peirce-Smith Converter

The half tones on pp. 718 and 719 are of historical interest in that they present, for the first time, views of the converter in which the basic converting of copper matte was developed to a commercial process by Messrs. William H. Peirce and E. A. Cappelen Smith, at the Baltimore Copper Smelting & Rolling Co.'s works.

The hole shown in the left end of the converter in the lower pictures was originally for a firebox, extraneous heat being necessary, as the first experiments were



THE TUYERES THAT BROUGHT SUCCESS TO THE BASIC-CONVERTING EXPERIMENTS

A—Tuyeres removed after production of 2900 tons of copper. B—New tuyeres for comparison. C—An 18-in. magnesite brick.

made with inadequate blowing facilities. The oil-heated firebox was finally abandoned when a regular blowing engine was installed and sufficient air obtained for the converting operation; when the experiments were started, it was not considered advisable to go to the expense of a regular blowing engine. The brick flue was built to take the converter gases and its shape was simply the result of the exigencies of the experimental work. The photographs represent the converter as at the time of the cessation of converting operations at Baltimore in February, 1910; it is, however, the original shell in which the basic-converting experiments were started in 1904 and the photographs are reproduced as a matter of historical record.

The tuyeres shown above were largely responsible for the commercial success of the process. Until the flexibly mounted iron tuyeres were developed, the basic-lined converter did not make a satisfactory copper production before the lining required repairs.

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Canadian Portland Cement Production, including slag cement and natural portland cement, in 1913, was 8,880,983 bbl. The quantity of Canadian cement sold or used was 8,658,922 bbl. The total imports of cement were 254,092 bbl. The total consumption of portland cement, therefore, neglecting a small export, was 8,913,014 bbl. for the year.

The Hall Process at Balaklala

Howard F. Wierum, who has been directing the experiments with the Hall process of desulphurization at the works of the Balaklala Consolidated Copper Co., at Coram, Calif., has returned to New York. He considers that the trial of the Hall process has been eminently successful, all of the chief points to be determined having been satisfactorily worked out, save one.

These points were: (1) The degree to which the production of sulphur dioxide could be avoided; (2) the cost of desulphurization by this method as compared with the cost of ordinary roasting; (3) the degree of desulphurization economically possible; (4) the collection of the elemental sulphur liberated by the process.

The experimental work at the Balaklala plant has been done with an ordinary McDougal roasting furnace equipped for oil firing and provided with the Hall control of combustion of the sulphur. The furnace was found to be able to roast 25 tons of ore per 24 hr., and in roasting ore of 10-mesh size reduced an original sulphur content of 40% to 4-5% in the finished product. As compared with the ordinary roasting process, this is highly favorable. The sulphur escaping as sulphur dioxide was but trifling and the cost of roasting was but little in excess of the cost of roasting in the ordinary way. Mr. Wierum considers that all of these points have been settled.

The matter of catching the sulphur liberated from the furnace has not yet been worked out satisfactorily. The effort has been to collect the sulphur in a Feld washer, the sulphur being obtained therefrom suspended in water and delivered into a tank having a filter bottom through which the water drains, leaving the sulphur behind. Difficulty was experienced in getting the Feld washer to perform satisfactorily, it being found to clog up badly.

The usefulness of the Hall process will, no doubt, be a matter for determination in each case where its application is contemplated. Anyway, it may be regarded as a noteworthy metallurgic development in its proved ability to desulphurize pyritous ore and deliver the sulphur in the elemental form.

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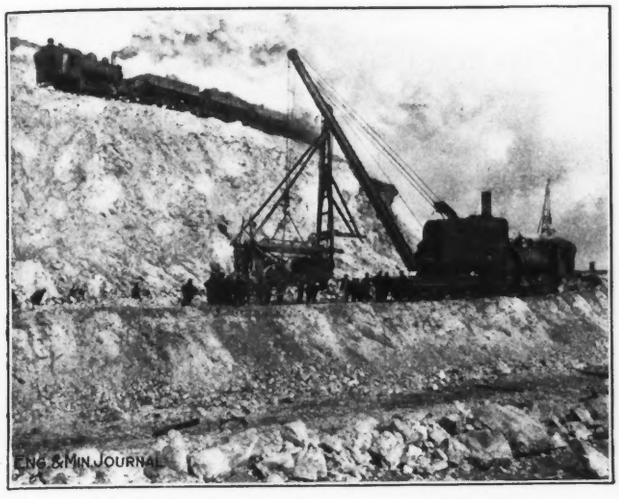
Sale of Steel Corporation Stock to Employees

In continuance of the plan observed in previous years, beginning with 1903, the employees of the United States Steel Corporation and the subsidiary companies were, in January, 1914, offered the privilege of subscribing for preferred and common stock of the Corporation. The subscription price was fixed at $105 per share for the preferred and $57 per share for the common stock. The annual allowances for five years for special compensation or bonus to be paid subscribers who retain their stock at $5 per share for the preferred and $3.50 per share for the common stock. The conditions attached to the offer and subscription, aside from the features of subscription price and the amount of special compensation or bonus to be paid, were substantially the same as those under which stock has been offered to employees in each of the previous 10 years. Subscriptions were received from 46,498 employees for an aggregate of 42,926 shares of preferred and 47,680 shares of common stock.

Moving Keystone Drill

The accompanying halftone shows a locomotive crane from the Bay City Industrial Works, Bay City, Mich., moving a Keystone drill. The drill was moved 1000 ft.



MOVING DRILL WITH LOCOMOTIVE CRANE

It was estimated that to move the drill under its own traction, including grading the road, would require 10 hr. with 12 men. With the crane it required only 40 min. with four men, including the engineer of the crane, thus effecting a great saving in time and money.

Report on Nomenclature of Alloys

At the Institute of Metals' annual meeting on Mar. 18, the British Committee on the Nomenclature of Alloys, consisting of representatives of the Institute of Metals, the Institution of Mechanical Engineers, the Institution of Electrical Engineers, the Institution of Naval Architects, the Institution of Engineers and Shipbuilders in Scotland, the North-East Coast Institution of Engineers and Shipbuilders and the Society of Chemical Industry (chairman, Dr. W. Rosenhain, F. R. S.), presented a unanimous report in which it recommends the adoption, first of a systematic nomenclature in which alloys are denoted by the names of their constituent metals in English, arranged in increasing order of percentage present in the alloys. This systematic nomenclature is intended chiefly for scientific and other purposes where its precise character more than outweighs its cumbrousness. The committee next recommends that a system of practical nomenclature should be set up, consisting of names which are to serve as everyday abbreviations of the systematic or scientific names. The definition of current practical names on this basis has so far only been attempted in regard to the two important terms, brass and bronze. The definition of brass adopted by the committee is that it is to be used as an abbreviation of the words zinc-copper as employed in the systematic nomenclature, when employed alone it indicates that the alloys are pure zinc-copper. Where the presence of other metals is to be indicated their names are to be prefixed to the term, forming such words as tin-brass, aluminum-brass, manganese-brass, etc. Similarly the term bronze is defined as an abbreviation for tin-copper as used in the systematic nomenclature, the definitions in other respects being identical as that for brass. The committee is not yet prepared to recommend definitions of further practical terms, but the two terms defined represent the most widely used alloys, and their general adoption as thus defined would do much to remedy the state of confusion which exists at the present time.

The Outlook for Platoro

BY CHARLES S. BARNES*

In the Platoro district, in southwestern Colorado, large, well defined fissure veins carry shoots of high-grade ore, principally refractory sulphides that could not be treated profitably a year or two ago. The owners of developed properties in the district have been holding on and watching for improvements in milling, that would permit mining the large bodies of this ore, assaying from $7 to $10 per ton.

The camp, being isolated, roads in bad condition and money scarce for mining developments, was practically inactive, until the news of the Gilmore find reached the outside world in October, 1912, and drew the attention of some of the mining operators of Cripple Creek to the district. Owing to the early snows that year, the many who came to the district were compelled immediately to leave again and defer a more thorough investigation until the next summer. Consequently, during the winter reports of wonderful finds in the Gilmore and other properties were published in the newspapers, by a certain class of "boosters," who had secured options on prospects, and were planning to unload their holdings, when the "main rush" would be on in the spring.

These reports brought in a large number of men looking for employment, and camp followers generally. Since the field men of the large mine operators had only just begun their examinations, and considerable time would necessarily elapse before their reports could be sent to their principals, there were no important sales being made, or properties being started up to give employment to the many looking for work, and there being no new discoveries of high-grade ore for shipment, either upon the Gilmore or other claims being developed in a small way, by the few prospectors actually working, the "boom" naturally "took a slump," and most of the transient population left the district, condemning it in loudest terms. In fact, the laboring men came into the district just a year too soon.

During the last year, certain properties have been examined, and the ores thoroughly tested by improved methods of cyanidation. A treatment process has been worked out, and certain well known mining men have secured options upon several of the developed properties, and are now cleaning up the old workings preparatory to a thorough sampling, and breaking of several test carloads of ore. This ore will be shipped outside, for a mill-run test in one of the modern cyanide mills. If the test on an actual milling basis will duplicate the results of laboratory tests, extensive developments and the installation of mills and a hydro-electric power plant will follow.

*Mining engineer. Platoro. Colo.

Although the snow is now 3 to 4 ft. deep, there is a good sled road, over which supplies of all kinds are being hauled, and good accommodations are to be found. Many who have been watching the camp, knowing that it was only a question of time when a successful method of treating the ores would be discovered, are now securing options on some of the best properties still to be had. Snow is fast melting, the hillsides exposed to the sun are becoming bare, and an early spring is assured.

Phelps, Dodge & Co.

The annual report of Phelps, Dodge & Co. shows net earnings by its subsidiaries of $11,245,064, of which $9,110,000 was paid to the holding company. This in turn paid $7,425,000 in dividends or 16.5%. From company ore, a total of 155,665,712 lb. of copper was produced, while including receipts from outside sources, 201,489,796 lb. were sold and delivered at an average price of 15.37c. per lb., net cash, f.o.b., New York.

The Burro Mountain and Chemung mines in New Mexico have been bought, and additions have been made to the property of the Detroit Copper Mining Co., where visible decreases have occurred in ore in sight. In the Copper Queen and Moctezuma mines, however, the reserves have been increased.

The total ores extracted amounted to a total of 1,978,892 tons, of which 1,122,372 tons were concentrated and 856,520 tons smelted. The total material smelted, including ore, concentrates, old slag, and cement copper, was 1,118,241 tons. The copper bullion produced, carried 31,141 oz. gold and 1,870,162 oz. silver.

In addition to the above, 15,573 tons of lead ore from the Copper Queen mines were produced and sold, yielding 290,789 lb. copper, 5,701,628 lb. lead, 203,214 oz. silver and 896 oz. gold. Of the ores and concentrates smelted, 1,035,367 tons were derived from the company's properties and 82,874 tons were purchased. The Stag Cañon Fuel Co. mined 1,322,813 tons of coal, of which 588,463 tons were consumed in the manufacture of 293,099 tons of coke. Detail reports of the various subsidiaries will appear later under "Company Reports."

Copper Exports of Japan

The following table, prepared by Otto Reimers & Co., of Yokohama, which we owe to L. Vogelstein & Co., gives the copper exports from Japan for 10 years past, in tons:

	Europe	America	China	India	Totals
1904	3,780	.....	15,560	1,271	20,611
1905	2,813	.....	17,242	52	20,107
1906	23,997	3,628	5,757	82	33,464
1907	13,670	3,569	14,002	410	31,651
1908	25,000	5,515	2,220	2,766	35,501
1909	22,170	9,528	1,589	2,088	35,375
1910	21,116	8,846	957	4,218	35,137
1911	17,288	11,009	3,688	2,322	34,307
1912	23,351	6,917	7,317	805	38,390
1913	19,843	5,543	13,320	3 574	42,280

Total shipments have shown a fairly regular advance and have more than doubled in the 10 years. The greater variations have been in the exports to China, which have changed sharply from year to year.

The Tulsa Spelter Co., in which Geo. E. Nicholson is interested, began the construction, on Dec. 10, 1913, of a 5-block plant, to cost $200,000, at Sand Springs, a suburb of Tulsa, Okla. The first block is expected to be in operation about May 1, 1914. Material from the old Cherokee-Lanyon plant, near Iola, Kan., which is being dismantled, is being used in the construction of the new plant.

Mining Dividends for March

In March, 1914, 27 United States mining companies making public reports paid $7,008,732 as compared with $9,450,635 paid by 28 companies in 1913. However, this difference is not really in favor of last year, since in the total for last year is included a $3,276,000 stock dividend paid by the Homestake company. Other notable changes between this and last year's reports are a decrease of $500,000 in the Calumet & Hecla disbursement, while Champion, Isle Royale and Quincy drop out altogether, to be much more than compensated for by Ray and Chino.

In the foreign field, 12 Mexican and Canadian companies paid $1,950,786 this year as compared with $1,479,100 in 1913, while metallurgical and holding companies pay $12,433,015 as compared with $12,464,228 a year ago. In this connection, we note a liquidation dividend by the Boston & Colorado Smelting Co., one of the old time standbys. This company was a remarkable dividend payer from its establishment in the '60s at Blackhawk, Colo., until 1902, when its plant in Denver was closed, disbursing over $5,000,000.

United States Mining Companies	Situation	Per Share	Total
Bunker Hill & Sullivan, l.s.	Ida.	0.25	$81,750
Bunker Hill Con., g.	Calif.	0.10	10,000
Calumet & Arizona, c.	Ariz.	1.25	748,741
Calumet & Hecla, c.	Mich.	5.00	500,000
Chino, c.	Ariz.	0.75	645,405
Federal M. & S., l.s.	Ida.	1.50	179,791
Fremont, g.	Calif.	0.02	4,000
Golden Cycle, g.	Colo.	0.03	45,000
Homestake, g.	S. D.	0.65	163,254
Hecla, l.s.	Ida.	0.02	20,000
North Star, g.	Calif.	0.30	75,000
Nevada Con., c.	Nev.	0.37½	749,796
Oroville Dredging, g.	Calif.	0.12	85,050
Pittsburgh Silver Peak, g.	Nev.	0.02	55,800
Ray Consol., c.	Ariz.	0.37½	543,951
St. Joseph, l.	Mo.	0.10	147,191
Superior & Pittsburgh, c.	Ariz.	0.30	569,922
Tennessee, c.	Tenn.	0.75	150,000
Tom Reed, g.	Ariz.	0.06	54,573
United Verde, c.	Utah	0.75	225,000
Utah, c.	Utah	0.75	1,187,760
Utah Con., c.	Utah	1.00	300,000
West End Con., c.	Nev.	0.10	186,848
Yellow Aster, g.	Calif.	0.05	5,000
Yosemite, g.	Calif.	0.01	2,400
Yukon Gold, g.	Alas.	0.07½	262,500
Yellow Pine, z.l.s.	Nev.	0.01	10,000

Canadian, Mexican and Central American Companies	Situation	Per Share	Total
Alacran, g.s.	Mex.	1.00	9,600
Blanca, g.s.	Mex.	0.90	63,000
Caribou Cobalt, s.	Ont.	0.02½	25,000
Chontalpan, g.s.l.z.	Mex.	0.75	5,250
Crown Reserve, s.	Ont.	0.02	35,376
Encino, g.s.	Mex.	3.03½[1]	9,105
Granby Con., c.	B. C.	1.50	222,721
Greene Cananea, c.	Mex.	2.00	972,417
Hedley, g.	B. C.	0.50	60,000
Hollinger, g.	Ont.	0.15	90,000
Kerr Lake, s.	Ont.	0.25	150,000
Lucky Tiger, g.s.	Mex.	0.07	50,074
Mexico Mines of El Oro, g.s.	Mex.	0.96	174,960
Reforma y Escorpion, s.g.	Mex.	2.50	10,000
Standard, s.l.	B. C.	0.02½	50,000
Temiscaming & Hudson Bay	Ont.	3.00	23,283

[1]Reduction of capital.

Iron, Industrial and Holding Companies	Situation	Per Share	Total
American Sm. & Ref. Co., com.	U. S. / Mex.	1.00	500,000
American Sm. & Ref. Co., pfd.	U. S. / Mex.	1.50	875,000
Boston & Colo., c. *	Colo.	3.00	22,500
Crucible Steel	U. S.	1.75	427,638
International Nickel	N. J.	2.50	948,133
International Smelting & Refining	N. J., Utah	2.00	200,000
Lackawanna Steel	N. Y.	1.75	612,115
National Lead, pf.	U. S.	1.75	426,433
National Lead, com.	U. S.	0.75	154,915
Phelps, Dodge & Co., c.	U. S.	4.00	1,800,000
Pittsburgh Steel, pfd.	Penn.	1.75	112,500
U. S. Steel, com.	U. S.	1.25	6,353,781

* Liquidation dividend.

Total payments for the first three months of 1914 are: By United States mining companies, $16,271,464; by metallurgical companies, $15,828,130; and by Mexican and Canadian companies, $5,365,157, as compared with $19,833,814; $15,145,045 and $6,566,936 for the same items of the corresponding period of 1913.

Correspondence and Discussion

Grinding Ores for Cyanidation

Referring to the letter by George E. Collins on "Grinding Ores for Cyanidation," where he compares the work of the tube mill with that of the Hardinge mill, I assume his tube mill is the ordinary type having the central overflow discharge. From both of these machines the pulp is discharged by displacement, and as Mr. Collins says, crowding the feed beyond the capacity of the mill for complete grinding will result in a coarser product, or more oversize.

Careful consideration will, I am sure, make it clear to any tube-mill operator that there can be no zone in any pebble mill where all of the particles of ore are of the desired size. This is true regardless of type of discharge. The varied sizes in the feed and the hindered progress of the particles of ore through the mass of pebbles, make it quite impossible for such a condition to be. It is because of this fact that the practice has become quite general of operating the tube mill in a closed circuit with a classifier, even with a central overflow discharge. Since, therefore, we find particles of the finished size throughout the entire cross-section of the charge, we are bound to get the best results from a mill which offers the easiest passage to such particles, to the outlet.

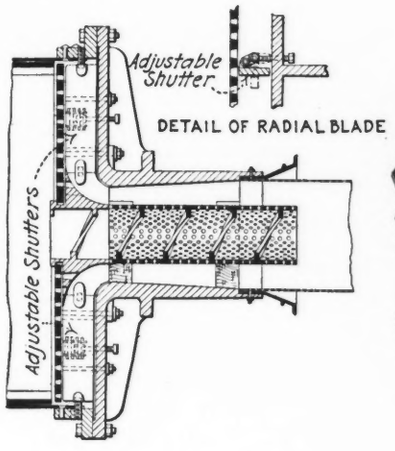


FIG. 1.

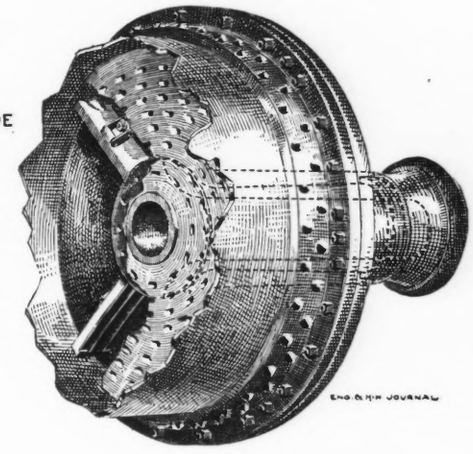


FIG. 2.

THE RAPID DISCHARGE SYSTEM FOR TUBE MILLS

It is evident that the conical end even though filled with pebbles, offers an easier passage than the square end. The crowding action of the feed can act from the center to the periphery in moving particles up the incline, but it is evidently much more difficult to force out the particles in the corner.

Many years ago, a device was developed at the El Oro Mines, El Oro, Mexico, to overcome the dead corner. This is like that in Fig. 1. It consists of the introduction of a false head made of perforated plates secured to the discharge end head by means of bolts and distance pieces, forming a space free from pebbles into which particles from the entire cross-section of the charge can freely pass and freely rise to the outlet.

This device improved the discharge in just the same manner that the conical end does, but to my mind in a greater degree, for I agree with Mr. Collins in being unable to see how there can be any really effective stage crushing in this cone.

In the mills of the Cobalt Lake and McKinley-Darragh Mines, at Cobalt, Ontario, I had an opportunity to compare the efficiency of an Allis-Chalmers 5x20-ft. mill with the ordinary central overflow discharge; an 8-ft. Hardinge and a Chalmers & Williams 5x16-ft. mill fitted as in Fig. 1, with perforated end plates and reverse-screw pebble feed, with the result that the efficiencies were in the reverse order, the Chalmers & Williams having the highest, the Allis-Chalmers having the lowest.

It is doubtless the effect of the dead corner that is responsible for tendency on the part of tube-mill users to lean toward shorter lengths, when using mills of this type, as there is eivdently a critical length of mill for each individual case beyond which the displacing effect of the feed is lost, due to the hindering action of the pebble load. The pebble load beyond this point is merely consuming power and using up pebbles uselessly.

The Chalmers & Williams adjustable quick discharge was developed to facilitate the passage of the pulp through the tube mill to an even greater extent than the inclined end or the device shown in Fig. 1. It consists of lifters so placed in the space betwen the perforated plates and the discharge-end head as to lift up and send out, through the trunnion, the pulp as fast as it accumulates. This action tends to create a void in the space behind the perforated places and can be varied from zero to full effect.

In general, the most efficient mill should be the one that provides to the greatest possible extent for the removal of particles of ore as soon as they have reached the finished size, for even though a large percentage of the discharge is returned to the tube mill as oversize, the useful work of the mill is increased by the exact amount of finished material removed to make room for so much more new material. I would like to emphasize this idea, for I do not believe that tube-mill users are keenly enough alive to the appreciable amount of both power and pebbles that are wasted on the finished material which is prevented from getting away.

By the use of the quick-discharge device, the entire length of a long tube mill can be made effective for fine grinding, thus increasing the capacity over the ordinary central overflow-discharge type of tube mill, or a greater capacity can be obtained in short mills for coarser grind-

ing, for I believe that where an all-slime product is desired, with this device the long mill will be the most efficient. But as I have said above, there is undoubtedly a critical length for tube mills beyond which they become less efficient on account of the hindering action of the charge of pebbles to the passage of particles of ore through the mill, which no type of discharge can entirely overcome.

W. B. EASTON.

Chief Engineer, Chalmers & Williams, Inc.

Chicago, Ill., Mar. 21, 1914.

Joplin Jigs for Iron Ore

I have noted Mr. Butcher's letter in the JOURNAL of Feb. 21, and the comment to the effect that the editor wishes to be shown that any machinery coming from the Joplin district can successfully treat the western Cuyuna and western Mesabi ores. He falls into the error of believing that the ordinary Harz jig is being used for this work. We make a type of jig which is used for this purpose and is particularly fitted for handling coarse material. We have probably 50 of these machines working on coarse iron ore up to 2 in. in diameter, and in one plant on ore sized from 2½ in. down. Beginning at 2 in., we make it into four or five sizes.

These machines handle from 20 to 25 tons per hr. The coarse tails are, of course, reground, resized and rejigged. The proportions of this machine are unusual, the cast-iron cylindrical plunger being 54 in. in diameter and the shaft 5 in. in diameter; the eccentric is self-oiled.

We are in receipt of a letter this morning from the general superintendent of a large plant in Canada, erected two years ago, in which this clause occurs: "The mill cost for the summer of 1913 was 9.28c. per long ton, calculated from a run of 80,000 tons. This included taking care of the tailings and the wages of one man feeding ore from bin to mill elevator. It also includes its proportion of local overhead charges. The mill was charged with one-third of the total power cost at the plant which was rather more than its just share, but we found it a convenient method of charging out the power. It does not include the cost of crushing the ore." We are also informed by this same company that throughout the entire season this mill was shut down only seven hours.

In some plants, we use a large Harz-type machine for handling material under ¼-in. In some cases we use the type of jig above mentioned for this same purpose, depending upon the particular conditions that are met. There is no more difficulty in handling western Mesabi and western Cuyuna ores by this process, where they are mixed with taconite and other forms of rock, than in handling the southern brown ores and the hematites of Canada. The truth is, the most difficult proposition we have ever gone against is the one referred to, which is at Bathurst, Canada. For in this particular case, it was not a question of separating iron ore from rock, but rather of separating a high-grade iron ore from a low-grade. The entire deposit from wall to wall is practically all mineralized; a considerable portion of it carried under 35% iron and there is little that does not carry as much as 10% iron. The average concentrates from the mill for the entire season ran about 50% iron.

On the western Cuyuna and western Mesabi, it will be easily possible to take ores carrying large percentages of pure rock and make a concentrate running from 57 to 62% iron, at a cost not to exceed 8c. or 9c. per long ton for all concentrating costs whatsoever.

A letter from our Joplin office states that we are now making a test for Jones & Laughlin, on a western Cuyuna ore that runs 40% iron and 33% silica. This is an unusually low-grade material for that country. The tests are going to show an average concentrate recovered, running 56% iron and 11% silica.

It is perfectly fair and truthful to say that we have developed this big, heavy machine during the last two years to a point of perfection away ahead of anything that has been accomplished before in this art. It is as near fool-proof as a machine can be built and it is so strong and heavy that the item of repairs is practically cut out of it.

G. H. ELMORE.

Pres. American Concentrator Co.

Philadelphia, Penn., Mar. 26, 1914.

The Wheeler and Krejci Converting Patent

Since basic converting first came into use, the coating that was formed on the brick lining has been recognized as adding to the life of the converter, and all those using the basic converters tried to get this result. No doubt Messrs. Peirce and Smith got this condition in their experiments and that is what made them successful in getting results. It was called slag coating and no doubt is a mixture of magnetite and slag. It was this condition they arrived at when they advised the formation of low-silica slags. Low-silica slag with the temperature kept low was just the right condition for the formation of this material.

I started basic converting at the Granby works in the old acid-barrel-type shells a short time after Anaconda got started and always tried for this condition, but not till about two years ago, while on a visit to Great Falls, and in talking to Mr. Krejci and to Mr. Wheeler, did I come to a full realization that it was a magnetite lining on the brick that we were all trying to get.

W. A WILLIAMS.

Anyox, B. C., Mar. 14, 1914.

Addicks & Brower Basic-Lined Copper Furnace

In the article on the Addicks & Brower basic-lined copper furnace in the JOURNAL of Feb. 21, 1914, there is one mis-statement; the text speaks of the magnesite bricks of the inverted arch terminating in a level top slightly above the copper line. This top is much below the copper line.

With reference to the operation of cathode furnaces, I may say that it is our idea eventually to conduct the operation without any blowing and with as little oxidation as possible. Separate patent applications have been filed covering different phases of this process.

LAWRENCE ADDICKS.

Chrome, N. J., Feb. 18, 1914.

Editorials

Revision of the Mining Laws

The bill for a commission to codify and suggest amendments to the general mining laws, as reported out of the Senate's Committee on Mines and Mining, by Mr. Walsh, was amended so as to provide for a commission of three, "two of whom shall be lawyers of large experience in the practice of mining law and one a mining engineer, who shall have had practical experience in the operation of mines." This commission is to hold public hearings in the principal mining centers in the western United States and Alaska and is to report a tentative code of mineral laws within one year after the passage of the act.

The amended bill is an improvement upon that which was originally drafted in that the limitation preventing the proposed commission from considering the question of lands containing coal, oil, gas, phosphates and potassium salts has been excised; and the composition of the commission has been beneficially altered.

In the latter respect, however, there ought to be further improvement. A commission of three is too small, we think, but especially is the predominance of lawyers objectionable. There is a prevalent idea that in the past there has been altogether too much participation by lawyers in the mining industry and that revision of the mining laws has been opposed by the legal profession, who prefer to see tangles requiring their services to any simplicity that would diminish the need of them. What the miners want is more simplicity, less uncertainty and less litigation. This proposed commission ought to be dominated by miners, not lawyers.

Then as to the miners, themselves, there is a big difference between the man who is experienced in prospecting and developing mineral deposits and the man who has merely had experience in the extraction of ore after it has been found and developed. A man of the latter class might be a highly experienced and successful operator, yet of no training that would render him a valuable member of this commission.

The shortcomings of our existing mineral laws are due largely to their having been enacted when the knowledge of mineral deposits was very imperfect. The proposed commission ought to include a mining geologist, well versed in the occurrence of ore deposits and their classification. It ought to include a representative of the prospectors—the men who find and develop mines—and a representative of the operators—the men who work them.

Moreover, the commission should be large enough to combine a wide and intimate knowledge of conditions obtaining in all parts of the country, where mineral lands are open to location. A large commission is unwieldy, but we do not think that a commission of seven would be too large in this case. Anyway, it ought to be as large as five.

However, it is good news to the mining industry that the movement for revision of the archaic mining laws of the land, which has been agitated so long by the national and local organizations of miners and mining engineers, is crystallizing in action by Congress with good promise of a satisfactory outcome. There are widely different opinions as to how revision should be done. Thus, among the mining societies there is nearly unanimous opinion that the law of the apex should be abolished, but outside of them there is an opinion, more or less widely held, that it should be retained. The idea that a discovery should not be a prerequisite to location is generally held, but the conditions that should obtain in making a location and keeping it arouse disputes. Even more disputable is the question whether the Government should be a grantor or a lessor. The existence of these debatable points, and many others, shows how necessary it is that the whole subject be studied by an expert commission, such as Congress is now considering.

The Decline in Lead Price

The reduction by the American Smelting & Refining Co. of its price for lead to $3.90 on Mar. 25 and to $3.80 on Mar. 30, were entirely unexpected actions outside of the council rooms of that company. An advance or reduction in the price for lead by the big interest is usually foreshadowed by the actions of other sellers. If the latter have sold all they want to, and demand continues, they will stand aloof and let the big interest meet it, in the course of which the big interest itself is likely to advance its own price. If, on the other hand, the outsiders want to sell lead, and demand is poor, they undercut the big interest's price, and themselves take the market, which leads sooner or later to a cut by the big interest if adverse conditions continue to prevail.

Last week, however, there was very little anticipatory shading of prices. Demand had been poor and transactions very light for a fortnight previous, but the general opinion was that the price for lead had bottomed. The American Smelting & Refining Co. inventories its unsold stock at 4c., New York, and presumably would not incur debits against its metal account unless there was very good reasons for doing so.

Among the small fry of the trade, which sees marketing operations in the light of a poker game, with bluffing, deception and trickery as the common manifestations, and regards the offices of the producers as being peopled by hobgoblins and evil spirits, whose malevolence is to be feared, the chief topic of gossip, whenever there be an unexpected cut in price, is "What malign motive lies behind it?"

The common-sense explanation that somebody has cut the price in order to sell his product is too simple to be held worthy of credence. The producer is considered to be someone who never ought to sell his product except at prices that please somebody else. If he can't sell at a certain price he ought to hold on. Now diamonds are a very nice thing to have, something to be prized, but

gem-dealers sell them because it is their business to do so. Lead also is a valuable commodity, but if a producer should find that his surplus were all lead and no money he would be in an embarrassed position. When a producer cuts his price the rational inference is that he does so to sell his product. If he finds that lead will not sell at 4c. he tries 3.90c. The successful marketing of any commodity requires a high order of ability. In the operation about the same rules apply, whether the article be copper or sugar, lead or leather.

Copper Converting Practice

The unusually large duty per lining obtained in the acid-lined converters at the Mammoth smelting works, in California, is worthy of note. From 20 to 27 tons of copper lining are now being obtained at Kennett from a matte averaging only 17% copper, whereas 20 tons of copper bullion used to be considered a fair duty for 8x12½-ft. acid-lined converters when treating matte of normal grade, say 42%. The Mammoth matte is of much lower grade than that usually converted, and indeed was formerly considered impracticable. Had not basic lining for copper converters become the general practice, this increased duty for siliceous linings would attract wide attention. The low converting costs attained at the Mammoth plant have been previously referred to, and the more detailed account of results, modestly described by Supt. J. H. Kervin on page 713, should interest the managers of those works that are still using siliceous lining. The reason for this large copper production at Kennett lies in the fact that the metallurgists have been able to get exceptionally good linings, which do not fall in, and that much loose siliceous ore is used in the converters, reducing to a minimum the silica required from the lining.

The Railway Situation

We have been hearing much about the railway situation, the sorry plight of the carriers since the cost of living has increased, since the operating men have enforced higher wages, since they have been compelled to carry unnecessary men in their crews, since the harrying by state legislatures has reached its climax, and since the Federal Government has taken away from the business of the express companies and caused the railway companies to transport the goods for nothing. Among rational people the last is considered to be downright cheating, although the postmaster-general with a sober face tells of the great profit the parcel-post is making.

In the meanwhile the distraught railway managers are begging the Interstate Commerce Commission for the right to increase freight rates. Mr. Brandeis is opposing them, and pending the decision the railways are limiting their purchasing, which has a seriously adverse effect upon the steel, copper, zinc and lead markets, and some others, transportation being one of the very great industries of the country.

But without waiting for the decision, the railways have been retrenching by reducing their service. Trains are being canceled, equipment retired, schedules lengthened, etc. Here we are getting down to the basic corrective.

If the railways be granted the right to increase rates there will be a revival in business, no doubt, but it will simply be another turn of the vicious circle. If the railways get more money by charging for car-spotting and tap-line service, as Mr. Brandeis wants, there will be simply a different distribution of wealth, the factories losing what the railways gain. But when the railways cut off unnecessary luxuries they make a real saving. If people can't afford to pay for conveniences, we need not say luxuries, they will have to do without them.

There is a popular theory that the national treasury is an inexhaustible store of gold, into which whoever wants battleships, canals, roads, public buildings, radium factories, etc., has but to dip his hand. The popular idea about railway treasuries is somewhat of the same order. There is difficulty in convincing people that they themselves have to pay for everything. In fact, however, we do not get anything that we do not pay for.

Therefore, if we are unable to pay for the railway service that we have been enjoying, we must be content with something inferior and cheaper. The luxuries of trains every hour to Philadelphia, no stops between, heavy buffet cars, etc., must be foregone. A trip to Boston is not so comfortable as it was a year ago. Later we may collectively have saved enough to have once more what we have been educated up to. We do not believe that the railways will unnecessarily retrench in maintenance, inasmuch as that would be foolish, and consequently we may expect to see them buying steel, copper, etc., ere long, but retrenchment in unnecessary service is a good economic indication.

Leadville Calamine

The present rate on calamine ore is $10.60 per 2000 lb. for ore containing 30% zinc, f.o.b. Leadville. This is based on 5½c. per pound of spelter at St. Louis, which is guaranteed as the minimum. For each unit of zinc under 30%, 90c. is deducted; for each unit above 30%, $1 is added. This price advances 50c. per ton with each advance of 0.1c. in the price for spelter. Certain smelters are taking low-grade calamine at $5 per 2000 lb., f.o.b. Leadville, for ore containing 22% zinc, with a variation of 50c. per unit up or down, this scale applying within the limits of 18 and 25% zinc.

These are extraordinarily favorable rates to the producer of the ore and indicate that for some reason or another the smelter must have it. One reason is, no doubt, that this ore requires less gas than in smelting blende, not having to be roasted, which is an important consideration with the smelters in Kansas and Oklahoma. Another reason is that the use of it enables a works to be run at nearly maximum capacity, which is desirable from the standpoint of working costs, without locking up very much money in ore or adding much to the product of spelter, wherefore losses do not pile up so fast as they might in smelting high-grade ore.

Reduced to the terms of the conventional zinc-ore formula, $(T - 8) - R$, in which T represents the units of zinc in the ore and R represents the smelting charge, the rate on 30% ore allows the smelter about $10 per ton as margin after delivery of the ore at his works on the basis of *5.5c. for spelter,* which is now worth but a trifle over 5c. The rate on 22% ore leaves about $7 per ton for the smelter.

Certainly the smelters are not going to get rich out of these contracts. On the other hand, there is nothing

very fat in them for the miners. The railway carriage on them is so low that no blame can reasonably be put on the railways. The trouble is that the ore is so very low in zinc that there is not much in it for anybody when spelter is at 5.5c. or lower. About 18 months ago, when the price for spelter was high, the smelters had a margin of $13 to $14 per ton on this ore.

BY THE WAY

The report of the American Telegraph & Telephone Co. throws an interesting ray of light on copper consumption. At the beginning of 1913 this company had 14,610,000 miles of wire in use. During 1913 a total of 1,500,000 miles were strung, an increase of a little more than 10%, without counting reconstructions. Of the total mileage in use, 92% is copper wire. These figures are particularly interesting in being the exhibition of an ultimate consumer, the class wherefrom statistics are seldom to be obtained.

The Australian government has offered a bonus of £5000 to the person or corporation that first obtains from a well in South Australia 100,000 gal. of petroleum containing not less than 90% of products obtainable by distillation. For a number of years, accounts of alleged petroleum discoveries on Kangaroo Island and the western coast of Eyre's Peninsula, South Australia, have appeared in the local press. As a result, says the *Financial Times,* Government Geologist L. K. Ward was instructed to investigate the region. Mr. Ward reported against the likelihood of oil being found in the region mentioned and concluded by saying: "In the light of what is yet known with regard to the districts, I am unable to recommend the expenditure of capital in boring for oil." However, in view of the great importance of an oilfield being developed in Australia, the government has offered the bonus, and possibly some adventurous spirits may spend their money where the government will not—which brings up a nice point in the discussion of governmental development of mineral resources.

The *Boston News Bureau* communicates the cheering news that shrewd watchers of the markets predict that when the present oil-stocks speculation has runs its course there will come a mining boom the like of which this country has never seen before. It is believed that the oil-share hysteria has reached its apex and is on the decline. Railroad stocks are no longer attractive speculatively. The downfall of many of the so called "good-will" companies gave a check to interest in industrials, and it appears that mining stocks are about the only class of issues that have not received several severe body blows in the last three or four years. Curb traders report that there is an interest and activity in outside mining stocks, such as has not been in evidence in the last four years. The 1907 panic put a check to the wild gamble in mining stocks that preceded that crash, but the speculative public is regaining its courage and is now nibbling strongly. Another mining boom would doubtless be accompanied by the usual outpouring of worthless securities, but the public is educated by observation and bitter experience, remarks our contemporary. We wonder if all this be so.

Some astonishing news from Cerro de Pasco is quoted from a writer in the *Sunday Globe* by the *Boston News Bureau.* Some of the choice excerpts follow: "The company has a great body of ore, of yet undetermined dimensions, right under the town, with veins running out in a dozen directions, and with the ore getting richer with depth. The machinery is the most modern type, with compressed-air drills, and the native miners, working in two eight-hour shifts and paid 60 cents and upward a day are excellent workers. Acetylene lamps are used, and cars are moved by gravity. The smelter, the largest outside the United States and patterned after that at Great Falls, Mont., contains the finest American machinery. It has three 300-ft. stacks, and runs three eight-hour shifts. Its building involved difficulties new to mine engineering. Experts declared furnaces could not be run at 14,000 ft. altitude, and under one engineer after another, while the company was spending millions, they did refuse to work. They finally worked, after a smelter man from Mexico, who declared they did not sound right, took off all the gages and put the blasts in such a way that he got the right Sound. Frank Klepetko, who built the Great Falls smelter, planned the machinery equipment. He introduced new inventions and put in treatments especially fitted for the high altitude. One curious device is called the cindering machine, which makes the fine ore into a coke so that it can easily be smelted." Perhaps the writer is not to blame, some of us have been at Cerro; *siroche* and *pisco* have "awful" effects.

We know of no "safety bulletin" published that is so well calculated to get the attention of the men to whom it appeals and thus to perform the most difficult task of inculating safety-first principles among employees, as that issued by the Nevada Consolidated. We quote below the last part of a short article in the February number, as interesting for its technical figurative language as for its truth:

> On the morn after pay-day, in the cold, grayish dawn, all their spirits were missing, their cash, too, was gone. 'Twas an accident, maybe, but oh! what a wreck; like a tenderfoot bumping a tin-horn's cold deck. Both their jobs amputated in one sudden jerk, with a traumatic ruptured relation with work; an internal fracture of conscience oblique, they were switched to the rip-track, disabled and weak. When their spirits returned and their heads ceased to pain, they made firm resolution, "No, never again." With new views psychologic, old habits reversed, they acknowledge the logic of old Safety First.
>
> SUGGESTION—The above effort in syllabication, accentuation and near-rhyme, descriptive of the near cause of many an industrial accident, is prompted by the following suggestion from an employee. This suggestion was received via the "suggestion box." There is more real poetry, more genuine sentiment and sincerity in the few brief words with which the recommendation is clothed than in any suggestion the safety department could make:
>
> 2-12-14.
>
> To the Safety Department: How to prevent accidents—close the ——— ——— saloons.
>
> ROASTER PLANT.

We are in hearty accord with the estimation of the Bulletin's editor as to the poetry, sentiment and sincerity in the communication. In connection with this, one of the trials of the Anaconda management is the influence on its men of the saloons in Dublin Gulch. A recent innovation is peculiarly exasperating; the saloons have introduced the practice of furnishing beer chasers. The explosion produced by a charge of rotten whiskey tamped with beer does not tend to reduce the accidental death rate.

PERSONALS

George O. Argall, general manager of the Iron Silver Mining Co., Leadville, Colo., was a visitor in New York last week.

J. M. Lovejoy, who has been in Chile for several years, and lately superintendent of the Cia. Minera Arrendetaria de Huantajaya, has returned to New York.

F. N. Flynn, metallurgist of the Arizona Copper Co., has been appointed superintendent of the company's new smelting works which are about two miles from Clifton.

H. Robinson Plate, of New York, has gone to Juneau, Alaska, expecting to stay there all summer on examination and development work for New York interests.

H. A. J. Wilkens, president of the Mines Management Co., New York, sailed for England March 21, and will spend two or three weeks there and in Germany in connection with the work of that company.

M. Kan Mapu and T. Konuma, of the University of Yokohama, Japan, representing the Japanese government, recently made a tour of inspection on the Mesabi Range, visiting the Alpena open pit near Virginia, and the underground operations near Eveleth.

Dr. Bell, representing Associated Gold Mines of West Australia and South Africa, who has been inspecting the Porcupine Gold (Vipond) and North Thompson properties in Ontario has gone to New York in connection with negotiations for the purchase of these claims.

Azor R. Hunt has resigned as superintendent of the Homestead Works of the Carnegie Steel Co. Mr. Hunt will terminate 30 years of service with the Carnegie Co. on May 1. He has been superintendent of the mills for 11 years. He has made no plans yet, but for a time he and his family will remain in Homestead.

E. L. Messler, formerly with the Jones & Laughlin Steel Co., as general superintendent of its Pittsburgh coke ovens, blast furnaces and ingot mold foundry and for the past two years assistant to the president of Riter-Conley Manufacturing Co. is no longer associated with the latter firm. Mr. Messler's present address is care of the Duquesne Club, Pittsburgh, Pennsylvania.

Noah H. Swayne, 2d., has resigned his position with Rogers, Brown & Co. to engage in business for himself. He has been connected with Rogers, Brown & Co., nearly 20 years and in 1900 was made president of the Alabama & Georgia Iron Co., Cedartown, Ga. He operated Cherokee furnace of this company until 1904, when he was made president of the Nittany Iron Co., Bellefonte, Penn., operating that furnace until 1906. On April 1 of that year, he became resident manager of Rogers, Brown & Co., at Philadelphia, a post he has held up to the present time.

OBITUARY

Edwin N. Coryell, consulting engineer, died suddenly Mar. 23 in New York, of heart disease, aged 66 years. He had been employed for 30 years as consulting engineer by the Cameron Steam Pump Works, owned by the Ingersoll-Rand Co., New York.

Benjamin C. Brundred died at Oil City, Penn., Mar. 28, aged 64 years. Born in Paterson, N. J., he moved to Oil City in 1866, and entered into the oil business with his father. Later he became treasurer and then president of the Eclipse and the Imperial Refining companies. When these were sold out to the Standard, he engaged in the oil-producing business with much success. He was also interested in a number of local enterprises and was prominent in club and social life and in charitable work.

Walter Laidlaw died suddenly in New York, March 25, aged 64 years. He had been for five years secretary of the International Pump Co. Mr. Laidlaw was born in Scotland in 1849, and after receiving a technical education in that country came to the United States and engaged in the machinery business. In 1886 he became associated with his brother, Robert Laidlaw, of Cincinnati, in the Laidlaw-Dunn-Gordon Co., manufacturers of steam pumps, which since 1899 has been a subsidiary of the International Steam Pump Co. In 1909 he came to New York and took the position of Secretary to the larger corporation.

SOCIETIES

American Chemical Society—The 49th general meeting of this society will be held at Cincinnati, Ohio, April 6-14. Headquarters will be at the Hotel Sinton, Fourth and Vine streets and meetings will be held at the University of Cincinnati. A very full program has been arranged, including general and sectional meetings, visit to points of interest and the usual entertainments.

NEW PATENTS

PURIFYING METALLIC MASS—Metallurgical and Chemical Process. John E. Bucher, Coventry, R. I., assignor to Nitrogen Products Co. (U. S. No. 1,087,900; Feb. 17, 1914.)

REFRACTORY BRICK. Henry Wessling, Hays Station, Penn. (U. S. Nos. 1,088,755 and 1,088,756; Mar. 3, 1914.)

REFRACTORY METALS—Metallurgical Method. Hans Kuzel, Baden, near Vienna, Austria-Hungary, and Edgar Wedekind, Strassburg, Germany, assignors to General Electric Co. (U. S. No. 1,088,909; Mar. 3, 1914.)

REVERBERATORY FURNACES—Improvements in Reverberatory Furnaces. Soc. Fr. d'Exploitation de Fours Speciaux a Haute Temperature, Paris, France. (Brit. No. 11,390 of 1913.)

ROASTING—Apparatus for Spreading Pyrites in Roasting Furnaces. Octave Battaille. Basècles, Belgium, and Pierre Pipereaut, Paris, France. (U. S. No. 1,089,304; Mar. 3, 1914, also Brit. No. 2367 of 1913.)

ROASTING AND SINTERING ORES, Apparatus for. John E. Greenawalt, Denver, Colo. (U. S. No. 1,088,818; Mar. 3, 1914.)

SINTERING ORES, Apparatus for. Albert F. Plock, Pittsburgh, Penn., assignor to Pittsburgh Metallurgical Co., Inc., Wilmington, Del. (U. S. No. 1,089,153; Mar. 3, 1914.)

STEAM SHOVEL—Reversible Dipper Tooth. Walter S. McKee, Glencoe, Ill., assignor to Edgar Allen American Manganese Steel Co., Augusta, Maine. (U. S. No. 1,088,916; Mar. 3, 1914.)

THORIA—Process of Extracting Thoria from Monazite Sand. Charles Baskerville, New York, N. Y., assignor to Welsbach Light Co., Gloucester City, N. J. (U. S. No. 1,087,099; Feb. 17, 1914.)

TITANIUM—Method of Making Titanium and Other Alloys. Ernest Kraus, Lynn, Mass., assignor to General Electric Co. (U. S. No. 1,089,773; Mar. 3, 1914.)

ZINC—Improvements in Retort Furnaces, Especially for Zinc Smelting. G. Londres and W. Worley, Grafton, Taylor, W. Va. (Brit. No. 11,900 of 1913.)

ZINC FURNACES—Apparatus for Manufacturing Receivers for Zinc Furnaces. B. Mohring, Dillingen-Saar, Germany. (Brit. No. 30,061 of 1912.)

ZINC-LEAD ORES—Treatment of Refractory Zinc-Lead Ores. Percy Claude Cameron Isherwood, Bushey Heath, England. (U. S. No. 1,089,412; Mar. 10, 1914.)

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC.

of The Engineering and Mining Journal, published weekly at New York, N. Y., required by the Act of August 24, 1912.
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The balance of the stock issued (less than 1% each) is owned by 69 employees, 3 ex-employees, and 14 others who are wives, daughters or relatives of employees.

Known bondholders, mortgagees, and other security holders holding 1 per cent. or more of total amount of bonds, mortgages or other securities. Mortgage on building held by Dime Savings Bank, Brooklyn, N. Y.

C. W. Dibble, Vice-President.
HILL PUBLISHING COMPANY.

Sworn to and subscribed before me this 24th day of March, 1914.

RICHARD L. MURPHY,
Notary Public.
(My commission expires March 30, 1915)

Editorial Correspondence

SAN FRANCISCO—Mar. 25

New Baghouse Has Been Completed at Vallejo plant of Selby Smelting & Lead Co. The building is of reinforced concrete, containing four compartments of 75 bags each. The bags are 30 ft. long. The total cost of the installation, including buildings and bags is about $60,000. This improvement for the elimination of fumes will probably satisfy the Solano County farmers, who have been complaining for several years and many of whom have collected damages or sold their lands to the Selby. A large percentage of the complaints were not well founded, but the farmers in this county, like those in Shasta County, have been persistent in their war against the smeltery. Since the investigation of the complaints was undertaken by the county, there have been fewer of them; and particularly since the baghouse at the Mammoth, in Shasta County, has proved satisfactory and shut off a lot of the complaints against the Mammoth, the farmers of Solano County seemed to have deemed it wise to await the completion of the Selby baghouse. No doubt, there will still be some insistence that damage is being done, but probably the end of the trouble is near.

Western Fuel Co. Officials, who were found guilty in the U. S. district Court, at San Francisco, of conspiring to defraud the Government, were sentenced, on Mar. 19, by Judge Dooling. James B. Smith, vice-president, general manager and director, was sentenced to 18 months' imprisonment and to pay a fine of $5000; Frederick C. Mills, superintendent, to 18 months' imprisonment; Edward H. Mayer, weigher, to 18 months' imprisonment. Smith and Mills were sentenced to serve in the state prison at San Quentin. Mayer will serve his sentence in Alameda County jail. Stay of execution was granted, and the bail increased from $3000 each to $10,000, $7500 and $5000, respectively. The maximum penalty provided by the law is two years' imprisonment and $10,000 fine or both imprisonment and fine. One of the grounds upon which new trial was asked was that one of the jurors referred his fellow jurors to accounts of the sugar-trust convictions and advising that if the sugar-trust men were guilty the coal men were also guilty. Judge Dooling agreed with the prosecution that appeal for relief on this ground should have been asked at the time of the discovery of the juror's misconduct.

SALT LAKE CITY—Mar. 26

United States Company's Coal Mines in Utah produced 860,000 tons for shipment during 1913. Production will be materially increased after the company's railroad has been completed, and more development done. From 2000 to 4000 tons per day are mined. The regular quarterly U. S. Smelting, Refining & Mining Co., dividend of 75c. per share on the common and 87½c. on the preferred stock has been declared, payable Apr. 15.

BUTTE—Mar. 25

Natural Gas at Havre has been found by the Havre Natural Gas Co., recently organized by business men of that city. The boring was made near the city and gas was found at a depth of 900 ft. Although not a strong flow, the gas burning to a height of seven feet when ignited, the company is encouraged, and will continue sinking to greater depth.

Ore by Parcels Post has been sent to the Washoe works at Anaconda. The consignment weighs 5 tons and was shipped by W. I. Wright, of Elk City, Idaho. He decided to take advantage of the parcels post to make a shipment of high-grade ore, and as Elk City lies just inside the second zone from Anaconda, he sent a consignment of 209 sacks of ore, weighing 50 lb. each, paying 54c. postage per package. As Elk City is 20 miles from the railroad, the Government was obliged to hire teams and wagons to convey the shipment to the railroad, and in order to get it to Anaconda, it had to be taken to Lewiston, Idaho, and thence to Spokane, which lies in the third zone.

Electrification of the Milwaukee Mountain Division between Three Forks and Deer Lodge, is to be started, the initial steps of organization will begin at once; Butte is to be headquarters. F. Beeuwkes, of New York, is to be the electrical engineer in charge of construction work. He is well fitted for the position, having held important positions with the New York Central and Great Northern railroads, in electrical construction work. The first work will be the installation of the trolley wire which it is estimated will require 1500 tons of copper. Power will be furnished by the Great Falls Power Co., the current to be conveyed over three high-tension transmission lines and delivered at three points; one at Deer Lodge, one at Donald, near the summit, and one at Three Forks. C. A. Goodnow, president of the Milwaukee road, said that barring accidents it is hoped to have the section of the line electrified by Jan. 1, 1915, and that it will be the policy of the company to complete the work on the entire line from Avery, Idaho, to Harlowton, Mont., as rapidly as possible.

DENVER—Mar. 27

Impassability of the Mountain Roads is at this season one pronounced obstacle to mining. If the roads have not been torn away or covered by snowslides or landslides, they are deeply buried in snow that is thawing unevenly and rendering the roads impassable for wagons or sleds. Many of the mountain roads are in such serious condition that pack animals cannot be used with safety. Such a state of affairs will continue for several weeks, for this has been an unusually severe winter. Many projects for reopening old properties or starting up new ones are being delayed for this reason.

New Wilfley-Mears Mill, at Silverton, is to be put into commission this spring, and in it will be conducted an interesting experiment, on a large scale. This plant, now nearing completion, is on the Silverton Northern R.R., a short distance from town, and near the Silver Lake mill, in Animas Cañon. It is planned to treat tailings from the old Silver Lake mill, which is at the mine, three miles distant from and 2600 ft. higher than the new plant. Transportation will be by sluice, using water from Silver Lake. The equipment of this mill consists of Wilfley tables and the necessary electrical motors for power. Estimates place the tonnage of tailings available for concentration at over 1,000,000.

Extension of the Roosevelt Tunnel, says James F Burns, formerly president of the Portland Gold Mining Co., who is acting as a committee of one in this matter, has been proposed and the proposition has been considered. The results of investigations lead him to conclude that the financial end of the project will be properly cared for and that engineers report no unusual physical difficulties to be encountered. While this tunnel has been driven simply as a drainage bore through barren formations, from now on, if continued, it will penetrate the producing area of the district. Present plans contemplate driving the tunnel to a point under the Elkton workings on Raven Hill. It is to be regretted that the valuable equipment used in the first driving of the tunnel was sold and is therefore not available for this new work.

CALUMET, Mar. 28

Caving in the Quincy lately resulted in the closing down of the No. 2 shaft for a short time until the fallen ground could be cleared. No one was injured. The caving caused "air blasts" which are not infrequent at this mine.

New Electrolytic Plant of the Calumet & Hecla Mining Co. has progressed so far that a part of the plant will go into commission within the next few days. The company is making plans for a large leaching plant. At the No. 2 regrinding plant the machinery is being assembled.

Quiet in the Copper Country has reigned for the last few weeks, the strike situation is gradually clearing, and the Federation members are returning to work. Committees of strikers, consisting of a representative of each nationality called on the mine managers to ascertain to what extent the members of the Federation would be taken back. They were given to understand that they could present their applications to the mines where they were employed, and while it may be impossible to give them their former jobs, it is likely that some work will be given them, but they will have to turn in their union cards.

NEGAUNEE—Mar. 28

At Norway, in Dickinson County, on the Menominee range, engineers of the Chicago & Northwestern R.R. have lately been engaged in making surveys preliminary to shifting the main line. The tracks at present cross the orebody of the Penn Mining Co.'s Brier Hill property. As it is intended to cave the surface in mining the deposit, it is necessary that the Northwestern build around the ground that is to be permitted to collapse. Additional railroad work in the vicinity will be an extension of the Wisconsin & Michigan R.R. to the Penn company's new Section Six property west of Norway. Section Six has been found to contain a large deposit of bessemer ore and will be developed this year. It is expected that by June 1, the Steel Corporation will be obtaining power from the hydro-electric plant under construction at the Upper Quinnesec falls of the Menominee River. The dam and power house are completed and much of the machinery is in place. The plant will serve the Chapin mine at Iron Mountain, in Dickinson County. Power derived from the Upper Quinnesec falls and generated in the way of compressed air has long been operating machinery at the Chapin, to which it is conveyed in a steel main 3½ miles long. The hydro-electric plant will produce upward of 5000 hp. at the start and is capable of considerable expansion. The electricity will be conveyed to the No. 2 Hamilton shaft, where it will be stepped down from 13,200 to 2300 volts. The current will be used to operate pumps and tram cars beneath the surface, and for various purposes above ground. The Chapin is an unusually wet mine, 3000 gal. per min. having to be pumped from a depth of 1400 ft. It is expected the electrical equipment will greatly reduce charges. A steam auxiliary plant will guard against shutdowns in the event of accidents to the riverside works.

Iron River Field has by no means reached the zenith of production. The outlook indicates a steadily increasing production for years to come, a fact recognized by the Chicago, Milwaukee & St. Paul R.R., which at large expense has extended its line 16 miles from Crystal Falls and will this year for the first time share in the ore traffic. Among the Iron River properties that will considerably expand their shipments the coming season are the Tully and Baker, twin mines of Corrigan, McKinney & Co. and which in 1913 sent out 41,000 tons of ore. The Tully is a new property, with a product of high grade. A second shaft has been sunk during the winter; 200 men are on the pay roll. Much new ground has been opened at the Baker, where a large body of ore developed the last few months has added materially to the life of the mine. The Baker is employing 100 men. Both it and the Tully will increase forces with shipping in progress. The development of the Tully will benefit the Great Western mine at Crystal Falls. This property is idle now, with a stockpile of large proportions. The Great Western produces a low-grade ore for which lately there has been little demand. While the Crystal Falls field has of late seasons been lagging behind its younger and more vigorous rival on the west side of Iron County, its production for 1913 will probably be doubled in the next few years. Three mines are in course of development, the Judson, of the Longyear interests, the Balkan, of Pickands, Mather & Co., and the Carpenter, of M. A. Hanna & Co. Two of these, and possibly the third, the Balkan, will join the ranks of the shippers this year. All three will be big mines and will greatly augment the production of the field, notwithstanding some of the old timers are passing out of existence. The Judson is in need of miners and will, it is announced, finance the erection of dwelling houses for married men that enter its employ. The Mansfield mines, which last year shipped a stockpile of 190,000 tons, will send out no ore the coming season, having been abandoned by the Steel Corporation. Whether the property will be operated again depends on the success of the fee owners in negotiating a new lease, a matter which at present is vague and indefinite. The Mansfield deposft is not exhausted, containing still probably 500,000 tons or more, but the mine is idle now and is dismantled; its total output approximates 1,500,000 tons. Two other Crystal Falls properties stripped of their machinery and abandoned are the Crystal Falls and Fairbanks mines of the Corrigan-McKinney group. Their combined output last year was less than 10,000 tons. The Crystal Falls still contains some ore, but it is probable it will be years before the property is restored to activity. The Hollister, which in 1913 sent out 25,000 tons, also will not ship the coming season, neither will the Armenia. The Hollister is a small property with an insignificant showing of unusually wet ore; it had been operated by M. A. Hanna & Co. The Armenia is a Corrigan-McKinney mine, which last year produced 85,000 tons. Compared with seasons past, Corrigan, McKinney & Co. lately have been operating their Crystal Falls group on a small scale. The company is building its own furnaces now, and with these in blast the Tobin, Dunn, Kimball and Great Western will, it is expected, be wrought vigorously and the Crystal Falls ore production will be given a strong boost upward.

ISHPEMING—Mar. 28

Lake Superior & Ishpeming Ry. Old Dock at Marquette is being dismantled. A few years ago only timber was employed in the erection of piers of this kind in the Lake Superior country. Now the wooden dock is out of date. The structures now being built are of steel and concrete. The old dock at Marquette saw 18 years of service, it having been used last season for the last time. It was necessary to wholly rebuild its pockets, after 10 years, and the structure was redecked twice. The only wood used about the company's new pier is found in the deck and in the pocket linings. Here there will have to be replacements from time to time. Otherwise the dock is a solid concrete and steel structure, with little of the steel showing. At the time the dock was planned the engineers, for the purpose of calculations, figured on a life of 30 years, but there is seen no reason why the structure should not be as serviceable and sound at the end of three decades as it is today. The exposure of steel is comparatively slight compared with the total exposed area and the steel skeleton of the dock is buried in concrete, where it is protected from the weather. The dock was planned to procure the greatest expedition in handling ore and loading ships and it has met the full expectations of the engineers. The pockets and chutes have been shown to be correctly designed, with the result that the dispatch obtained is not equaled anywhere on Lake Superior.

EL PASO, TEXAS—Mar. 17

Texas School of Mines is to be established at El Paso; $33,000 having been pledged by the business men of the town toward purchasing the old military institute buildings which will be turned over, after the full purchase price of $50,000 is secured, to the state of Texas as a site for the school. The business men who have pledged the $33,000 are lending the El Paso chamber of commerce the necessary financial assistance in securing the military institute buildings until such time as the amount can be paid from the budget fund of the chamber of commerce. It is thought that within the next two weeks the balance of the amount needed to purchase the buildings will be subscribed and the property turned over to the state.

TORONTO—Mar. 27

A Reward for Radium Discovery is recommended in a bill now before the Ontario legislature authorizing the government to give a reward of $25,000 to the first discoverer of radium in commercial quantities. [Why not offer the prize for discovering a use for radium that nothing else fulfills?—Editor.]

Canadian Venezuelan Bondholders' Meeting has been called to consider the report of the engineer who recently made an examination of the properties. The report has been presented to a special committee and will be passed on at the bondholders' meeting. It has not as yet been made public, but is understood to be unfavorable and it is probable that the property will be sold rather than reorganized.

New Workmen's Compensation Act for Ontario will probably be in force by next November, and in any event it will become operative Jan. 1, 1915. The bill has passed its second reading in the Ontario legislature and as it is not a party affair, and has the support of both sides of the house, there does not appear to be anything that will stop its enactment. Despite the strenuous protests made by the Canadian manufacturers and other interests, few changes have been made in the bill as originally drafted by Sir William Meredith. While the manufacturers' association has been opposing this particular bill, they are in favor of compensation and it was due to the association that action was first taken. They, however, with other employers, object to the terms of the proposed act, as they consider the amount of compensation too high and the number of employees altogether too large for legislation which has not been tried out, as this proposed act is more comprehensive than any similar legislation in any country in the world. The government will include in the estimates an annual payment of $100,000 toward the administration of the compensation commission. It is not known whether this sum will cover the cost of administration and if it is not sufficient, the industries covered by the act will have to bear the balance of the cost. The names of the members of the commission have not yet been decided upon.

The Mining News

ALABAMA

Jefferson County

WOODWARD IRON CO. (Woodward)—No. 3 furnace was blown out Mar. 26. Extensive repairs and alterations will be made.

ALASKA

AN IMPORTANT LEGAL DECISION, the first interpretation of the Wickersham act of Aug. 1, 1912, was handed down at Cordon Mar. 18 by Judge Frederick M. Brown. Case was that of C. H. Likaits vs. William A. Johnson about Chisana claim No. 1, above discovery on Bonanza Creek. Decision establishes right of defendant to title to ground and is first case to be decided of controversies which will come up this summer over much of the ground at Chisana. Action by plaintiff was based on contention that agent of defendant had failed to comply with law governing location of placer claims, inasmuch as he had failed to file a power of attorney drawn in Dawson, dated June 7, 1909; that when James had gone to Chisana he had not taken the power of attorney with him, but had left it at his cabin, 40 miles from headwaters of the Chisana, when he made the discovery on Bonanza. Nelson, the partner, had gone to Dawson for more provisions, and had learned for the first time the change in mining laws providing that powers of attorney must be filed with recorder of the district. Immediately upon his return to Chisana from Dawson, in June, 1913, he informed James of the law. James sent a man named Gates to his cabin on Beaver Creek to obtain the power of attorney that it might be filed when recorder for new mining district opened his offices. In meantime James, as attorney in fact for Johnson, had performed all the acts required by law in the matter of making discovery and marking boundaries of claim. Aug. 7 he had filed notice of location and recorded power of attorney from Johnson to James. Plaintiff arrived on ground Aug. 20 and located the claim on the following day. Decision of court related to a construction of intent and language of Wickersham law relating to recording of powers of attorney. Sole question was, "Does act require power of attorney to be recorded prior to location of claims?" Court held that recording of a power of attorney was but one of a series of acts necessary to constitute a valid entry, that the order in the time in which the acts were performed was immaterial, provided all were performed before the rights of other locators accrued. The decision in this case has no bearing on the territorial act which expressly provides that the power of attorney must be recorded prior to agents staking claims for the principal. The ruling in this case, which was argued before the court on an agreed statement of facts, also applies to the cases of Foster vs. Johnson, involving No. 1, Chatenda Creek, and Nikell & Foster vs. Johnson, No. 8, Bonanza.

ALASKA-EBNER (Juneau)—A decree of foreclosure and sale in suit brought against Alaska-Ebner Gold Mines Co., and other defendants by Guaranty Trust Co., was signed by Judge Lacombe last week in the Federal district court. Property to be disposed of consists of 1,700,350 shares of stock of Bristol Consolidated Mines & Smelting Co., 199,996 shares of Day-Bristol Consolidated Co., 100,000 shares of Ebner Gold Mining Co., 1000 shares of Humboldt Mining Co., and property at Juneau, Alaska, and Madera, Calif.

ARIZONA

Maricopa County

RED ROVER (Phoenix)—A new hoist has been installed and shaft is being unwatered.

GARCIA (Wickenburg)—Shaft is being unwatered and underground development will soon be started.

SLOCUM COPPER CO. (Phoenix)—Ore is being hauled to Phoenix for shipment to smelter. It is probable that active development of property will be resumed at an early date.

Mohave County

COPPER GIANT (Hackberry)—Shaft is now down to 400-ft. level. A short distance below 300-ft. level vein narrowed somewhat but shaft is now in a wide shoot of good ore.

FREE GOLD (McConnico)—This group, belonging to McKesson estate, has been sold to A. S. Hart and Albert P. Hunter, of Albuquerque, N. M. Main shaft is to be unwatered and then active operations will be begun.

Pinal County

KELVIN-SULTANA (Kelvin)—Westfall shaft was sunk 39 ft. in first half of March. East drift on No. 1 vein at 400-ft. level is opening up 4 ft. of excellent ore. Crosscut from bottom of No. 2 winze has cut No. 2 vein, which is only 2 ft. wide at this point, but shows unusually high-grade gold ore. Construction has been begun on the foot-bridge across the Gila River.

LONDON-ARIZONA (Winkleman)—Company which recently absorbed properties of London Range Copper Co., London Shamrock Copper Co. and Bali Copper Co., is doing a large amount of construction work preparatory to resuming operations on a larger scale. A larger compressor and a new hoisting plant have been installed at Curtain shaft, where first work will be done. This shaft is now 300 ft. deep and sinking will be continued.

Yavapai County

FORTUNE (Prescott)—Tunnel on this property, which was formerly known as Wizard claim, and which is at head of Big Bug Creek, has been driven 900 ft. in ore. Construction work on mill purchased by company some time ago will begin in near future.

Y. P. (Senator)—Connection was recently made between first and second levels, blocking out a large shoot of ore, which has been drifted on for 600 ft. Several hundred feet below lowest shaft level two veins have been explored from a crosscut driven from Senator tunnel. Getchell vein, 60 ft. west of Cash vein, shows fine ore.

MONTE CRISTO (Wickenburg)—Company is considering construction of an aërial tramway from mine to Hassayampa, a distance of 12 miles. Company recently acquired a large tract of land near Wickenburg for a millsite. Blocking ore on 700-ft. level has nearly been completed and shaft will probably be continued to 800-ft. level.

CROWN KING—For first time in several years there is evidence of life around this and the Saratoga mine. These mines were taken over a short time ago by O. J. Blickenstaff and Henry Braun, who purchased old Lucky Star mill, at Jerome Junction, and moved it to property. At present material from dumps is being treated, but it is expected that work in mines will be resumed in a short time. First cleanup was made recently.

HAYNES COPPER CO. (Jerome)—Shaft has been sunk to twelfth level and diamond drilling has been done toward west fault at 417 ft. A rush of water was encountered and drill hole had to be capped until an electric pump of 200 gal. capacity can be installed on 1200-ft. level. Meanwhile diamond drill is at work on other side of shaft, and at 371 ft. passed through some ground showing native copper. Before other diamond-drill hole was capped, it encountered several stringers of chalcopyrite. On 1200-ft. level, drift has been driven 175 ft. toward north fault.

Yuma County

BULLION (Bouse)—This and Old Dutchman groups of copper-gold mines were recently acquired by R. King, of Los Angeles. Two groups adjoin and lie about six miles southwest of Bouse. A force of 45 men is already at work on the Bullion. It was on the Dutchman that recent gold strikes was made, causing considerable excitement around Bouse.

CALIFORNIA

Amador County

PLYMOUTH CONSOLIDATED (Plymouth)—Grading for mill about complete. Parts of machinery on ground. Freight is wagon-hauled from Latrobe.

CENTRAL EUREKA (Sutter Creek)—After long idleness, stamp mill is crushing $10 ore, which is high-grade for this district. Vein disclosed is narrow but extensive.

FREMONT (Drytown)—The 2250-ft. shaft is being deepened to 2350 ft. Mine has been a producer and dividend payer for a long time, and prospects are good for a long extension of life in that oreshoots are showing indications of persistency.

TREASURE (Amador City)—Shaft is now down 1600 ft. Mine was partially developed several years ago, and was reopened about two years ago by E. S. McCurdy, of San Francisco. Indications of making a producer are said to be improving.

Calaveras County

CALIFORNIA MINES CO. (San Francisco)—New incorporation with head office in Minneapolis, Minn., and capitalization of $500,000, organized to operate in Calaveras and Plumas Counties. Officers are D. C. Demarest, of Altaville, president; J. Emil Nelson, of Minneapolis, secretary-treasurer. George Louden, of Minneapolis, is consulting engineer. Options have been taken on patented claims on Stanislaus River,, formerly known as Calaveras mines, in vicinity of Carson Hill.

Eldorado County

SLUG GULCH (Fairplay)—This placer mine, which was a producer in early days, has been taken over by Eastern men, James Moir, W. S. Scofield and others. Price is said to be $30,000.

Nevada County

NORTH STAR (Grass Valley)—It is reported that management contemplates deepening 5400-ft. incline shaft. Kennedy vertical shaft is now 3900 ft. deep and Argonaut about 4000 ft. inclined. These are deepest shafts in California.

Tuolumne County

SOULSBY (Soulsbyville)—It is reported that 800-ft. shaft will be unwatered and mine reopened.

STANISLAUS (Jamestown)—A miner was killed, Mar. 12, in a raise. He is supposed to have fallen from a ladder.

McCORMICK (Jacksonville)—The 1300-ft. tunnel is to be advanced to 1350 ft. in belief that orebody will be reached.

ITALIAN RANCH (Sonora)—W. H. Knowles, of Los Angeles, and others, have taken a lease and are sinking on north end of property. Shaft is down 60 ft. on vein.

SPRINGFIELD FLAT TUNNEL & DEVELOPMENT CO. (Sonora)—Adit is being driven from Deadman's Gulch, on western slope of Stanislaus Cañon, to tap Buchannon and other channels. It is now in 600 ft. and will be advanced to 1700 ft. Tunnel floor is 100 ft. below bedrock of converging channels graded for drainage.

COLORADO

Boulder County

YELLOW PINE (Crisman)—About 80 lessees are working this old mine. Plans have been made for erection of a 150-ton custom concentrating and amalgamation mill at Ward.

CARIBOU-POORMAN (Caribou)—H. P. Lowe is making preparations to start work in this tunnel which is now in 4600 ft. but which is planned to be more than 11,000 ft. long. Its purpose is drainage and transportation.

UNITED STATES GOLD (Boulder)—Erection that was interrupted by severe wintry conditions has been resumed and building is nearly completed. Equipment of this mill will be ready for use within two months. Ore for this plant will come from Livingston and other mines of this corporation. Owners of other properties will be privileged to test commercial lots of their ores in this plant.

Chaffee County

GOLD QUEEN (St. Elmo)—Company contemplates driving adit to intercept Black Diamond vein of adjoining Mary Murphy property.

Clear Creek County

ELLA McKINNEY MINING CO. (Idaho Springs)—Property of this company, on Ute Creek, has been purchased by Edward S. Johnson.

SILVER CREEK MINING CO. (Idaho Springs)—This company, through its attorney, A. D. Bullis, has purchased under foreclosure sale properties of Alice Development Co. and Alice Gold Mills Co., consideration was $215,187.

COLORADO MINES & DEVELOPMENT CO. (Idaho Springs)—This is a new organization incorporated by George E. Armstrong, J. H. East and Clarence R. Anderson. Company will operate mining property in Gilpin, Clear Creek and Summit Counties. Capitalization is $100,000, with shares at $1 par.

Dolores County

RICO-ARGENTINE (Rico)—Shipments have resumed from Blackhawk mine in Silver Creek. Report says that Knight interests are negotiating for all properties of this company.

Gunnison County

VOLUNTEER (Pitkin)—Extensive development by raising and drifting is in progress. While a little ore is being mined, real production will be postponed until later in season when mill will be put into commission.

ALASKA-YUKON (Parlins)—Bruce Redden and D. L. Gray, holding option to purchase, are unwatering this mine that was abandoned years ago because of excess of zinc in the ore. It is now proposed to mine from a 50-ft. vein rich in zinc and carrying small amounts of gold and silver.

Lake County

BIG FOUR (Leadville)—Suit has been brought against company to satisfy judgment on liens for labor and supplies.

PROGRESS MINING & MILLING CO. (Leadville)—This new incorporation will operate in this district. Directors are: W. B. Brooks, W. P. Dunham, Edgar T. Wallace, George W. Ballou and L. A. Dunham.

GARBUTT (Leadville)—Main shaft, now 1100 ft. deep in cambrian quartzite, is being sunk another 150-ft. lift. This will make it one of the deepest mine workings in district, actually and geologically. Exploration of this low zone will be watched with interest.

IBEX (Leadville)—Several new leases are starting. Heavy tonnages of oxide and sulphide ores are shipped daily, and No. 1 shaft is worked to capacity. Corticelli lease on third level of Little Jonny has opened a vein at least 25 ft. wide of solid smelting ore. Stoping shows ore to extend 30 ft. above level, but miners expect it will reach to surface.

JONES & AUGUSTINE (Leadville)—These men, the former until lately an employee of Bartlesville Zinc Co., at Bartlesville, Okla., and latter an employee of Ozark Zinc Oxide Co., at Coffeyville, Kan., intend to build a plant of Wetherill furnaces, bag house, etc., for treatment of low-grade calamine at Leadville, Colo. They plan a plant of 50 tons daily capacity, intending to use anthracite fines from Crested Butte, and to treat ore containing 14 to 18% zinc.

Pitkin County

URANIUM ORE IS BEING EXHIBITED IN ASPEN and prospectors are preparing to investigate certain formation in outlying portions of county. Ore carries silver in addition to uranium.

San Juan County

INTERSECTION (Silverton)—Small mill is again running since flow of water has resumed in creek.

HERMIS (Animas Forks)—Vein recently cut in lower crosscut is improving in size and grade with development.

SUNNYSIDE (Eureka)—After shutdown, due to fire and snowslides, mine and mill are again running and shipping concentrates.

GOLD KING (Gladstone)—Through lack of railroad service, this mine has been unable to work to normal scale. Coal is short and bins are filled with concentrates. Some supplies have been packed up from Silverton by men.

San Miguel County

CLOUD & SAUNDERS—These two groups in carnotite belt of western part of county and not near any towns have been acquired by A. E. Minium, of Denver. A small lot of material recently shipped to Denver ran 2.76% U_3O_8, 10 men are developing.

Summit County

SPELTER KING (Montezuma)—Bolivar Mining & Milling Co. is developing high-grade sphalerite and shipping a small tonnage.

FRENCH GULCH DREDGING CO. (Breckenridge)—Reiling dredge has been bodily moved upstream overland and has been reset in what is presumed to be the richest proved tract of district. Operations will be resumed with warmer weather and as soon as pit can be rendered water-tight.

TONOPAH PLACERS (Breckenridge)—Two Bucyrus boats of old Colorado Dredging Co. are being overhauled. No. 1 boat will remain in Blue River, No. 2 boat will continue up Swan River into richer ground. Dredge of former Reliance company is working up French Gulch from junction with Blue River. This boat has for years been only one able to operate all winter, it being provided with suitable protection from weather and with heating arrangements that prevent freezing of stream in its flow over gold-saving tables.

MICHIGAN

Iron

KLOMAN (Republic)—Men from Chicago, who claim to have a process for treating low-grade iron ores, have been looking over Kloman with an idea of taking a lease or purchasing. Just what process it has not been made public. Kloman was opened by John Jones, of Iron Mountain, and associates, three years ago, and an Ardis furnace erected, but no ore was ever treated. It is known that there is considerable low-grade ore in mine.

DEXTER (Ishpeming)—Cleveland-Cliffs Iron Co. is repairing deepest of two shafts at old Dexter property, seven miles west of here, and work of removing water from lower part of workings will be startetd shortly. When water is out, diamond drills will be put in commission on bottom level for purpose of checking up drilling that was done years ago, where some ore beds were located. If ore in sufficient quantity is found, it will be mined through company's Chase mine, which is only a short distance away. A steam line is now being run from Chase to Dexter and transmission line is also being extended there. Dexter has not been worked in about 10 years.

BALKAN (Alpha)—Pickands, Mather & Co. has awarded a contract to Winston Bros., of Minneapolis, to strip part of this property. Work will be commenced within a week or 10 days. Job is largest stripping contract ever let in Michigan and Balkan will be largest open-pit mine in state. Overburden runs from 8 to 30 ft. in depth and extends over quite an area. Accommodations are now being made for contractors' men and machinery will be on ground when camps are ready. Balkan orebody is large, part of it is now being developed through a shaft, where ore lies at a considerable depth. It is estimated that it will be an easy task to get out 1,000,000 tons a year from pit alone.

MINNESOTA

Cuyuna Range

CANADIAN-CUYUNA ORE CO. (Brainerd)—Shaft, upon which sinking has just started, has been named "Wilcox." It will be a three-compartment timber drop-shaft. Mine will not produce until 1915 season.

IRON MOUNTAIN (Iron Mountain)—Mine all in readiness for season, with ore blocked out and equipment in shape. A trial shipment was made to an Eastern furnace for test during winter, which, management asserts, has been entirely satisfactory. Ore is manganiferous, but lower in grade than ore now being hoisted from other manganiferous deposits on range.

CUYUNA IRON & MANGANESE ORE CO. (Ironton)—Drilling on this property continues to increase tonnage. Hole No. 42, 600 ft. west of No. 41, is reported to be in 60% ore. Discovery of such a deposit of ore on this once abandoned 80-acre tract has been one of season's surprises on range, and, although drilling is still far from complete, it would seem that company is developing a stripping property. Surface material is comparatively shallow, from 45 to 60 ft. in depth.

MISSOURI-KANSAS-OKLAHOMA

Joplin District

GARNER (Galena, Kan.)—This old property is being worked by Henry Poole, Charles Williams and Jesse Boone. Operations are below former workings and good ore has been found.

DALLAS T. MASON (Joplin, Mo.)—A 25-acre lease of American Zinc Fields Co., at Webb City, Mo., is being drained and a 10-ft. face of zinc ore will be developed. Two shafts are in ore.

BIG BROWNIE (Cave Springs, Mo.)—Demerath & Sparks, of Galena, Kan., have leased property and will resume open-pit mining. Open pit is 40 ft. deep, and big tonnage was taken out by former operators.

CORNFIELD (Miami, Okla.)—Pumping equipment is to be installed at this mine soon. Shaft is in good ore at 101 ft. Nine drill holes have been put down, eight showing ore. Property is in virgin territory.

SCHOENHEER-WALTON MINING CO. (Carterville, Mo.)—Plans are being made for rebuilding concentrator recently destroyed by fire at a loss of $20,000. Mill was of 200 tons capacity but will be replaced by 250-ton plant.

PELICAN (Joplin, Mo.)—Ground will be drained soon and big pumps moved to Bob Ingersoll mine on same lease. With water out, two mines will be operated from lower workings. Properties are on United Zinc Co.'s land.

YELLOW GIRL (Galena, Kan.)—Mine has been reopened and drift is being driven to old drill hole in which calamine and galena were shown in drill cuttings. Mine is owned by A. C. Patterson, E. R. Wheeler and Thomas Patty.

EUREKA (Duenweg, Mo.)—Concentrator destroyed by fire recently had been idle few weeks, awaiting expected improvement in ore market. Mine has produced big tonnage of blende; is owned by C. M. Spring, of Joplin, and is on Crown Crest land.

POCAHONTAS LEAD & ZINC CO. (Joplin, Mo.)—This company has made four good strikes with drill on St. Louis-Joplin land. Drill cuttings showed ore at a depth of from 160 to 200 ft. Same company owns Pocahontas mine, at Thoms Station.

MONTANA

Cascade County

BUTTE & PENSACOLA COPPER MINING CO. (Butte)—A large shoot has recently been cut in upper tunnel of Excelsior mine, 12 miles from Logging Creek, a station on Neihart branch of Northern Pacific Ry. Tunnel is being driven to intersect Excelsior vein which outcrops on surface. New shoot struck in tunnel was not known to exist as it does not outcrop on surface. It was encountered unexpectedly about 25 ft. from where Excelsion vein is supposed to be. Assays show gold and silver with a little copper.

Gallatin County

GARFIELD MINING CO.—This company has recently been organized by J. H. Congdon and Charles Stanley, of Butte, to develop a group of claims in Springhill mining district near Manhattan. A shaft with crosscuts has opened a 15-ft. vein of ore carrying copper and silver. Company contemplates driving a long tunnel to tap vein at a depth of 640 ft. below surface. Discovery of ore on this property has attracted a number of prospectors and miners who are making extensive preparations for investigating possibilities of district.

Granite County

SWASTIKA (Philipsburg)—Ore has been blocked out and all necessary machinery is in place to begin operations on a large scale. A station is being cut on 160-ft. level, after which shaft is to be sunk 200 ft. deeper.

NORTH STAR MINING CO. (Maxville)—Company is making regular shipments of high-grade copper ore to Anaconda and is erecting a large concentrator to treat low-grade ore, large quantities of which have been blocked out in upper levels.

Lewis & Clark County

NORTHWESTERN METALS CO. (Helena)—Results of trial tests going on at plant of this company are subject of much curiosity, inasmuch as great claims are made for the process by C. C. Titus, its originator. Experiments carried on for a number of years, however, proved so successful, that well known men have financed the enterprise. Briefly, process is as follows: Ore is crushed to ¼-in. size and dried in a furnace. It is then delivered into chambers where it comes in contact with chlorine gas, generated from salt. From chloridizing chambers ore goes to agitating tanks where metals which are now in form of chlorides, are dissolved in water, thus separating from gangue and waste material. Solutions then go through filter presses where iron and manganese are extracted, while gold and silver and lead are precipitated from liquid by zinc shavings. Zinc is precipitated electrolytically as metallic zinc, zinc oxide or zinc carbonate. For ease of handling chlorine gas is converted into a liquid and in that state is conveyed to apparatus where it is used.

Silver Bow County

AT A BROTHERHOOD OF ELECTRICAL WORKERS special meeting, Mar. 23, local union decided, by a vote of 81 to 14, to leave the Reed-Murphy faction and join the McNulty faction, the latter being the branch of the Brotherhood of Electrical Workers that is affiliated with the American Federation of Labor, and is recognized by this labor federation. This practically ends long strife between two factions in Butte and action of Butte local will probably be followed by similar action on part of other local Montana unions of electrical workers and will eventually bring them all under the American Federation of Labor.

BUTTE & SUPERIOR (Butte)—On his way to Alaska, D. C. Jackling stopped at Butte, Mar. 23. Speaking of recently discovered oreshoots on 1400-ft. level, he says that they are continuations in depth of those found on 1100-, 1200- and 1300-ft. levels and that company fully expected to meet them on 1400 level and that they were therefore not a new vein as rumored. However, fact that grade of ore was equal to that on upper levels and that orebodies extended farther east than looked for, proved a pleasant surprise. Present output of about 1000 tons per day is to be maintained as long as price of spelter remains at its present low level.

ANACONDA COPPER MINING CO. (Butte)—C. F. Kelley, vice-president, has announced that company is planning to install a mining exhibit at Panama-Pacific Exposition at San Francisco. It will include a collection of all kinds of ore from its Butte mines together with results of various metallurgical processes, showing each step taken, from mining to finished product. Bell and Diamond mines have been closed in order that necessary repairs may be made, and it will probably be two or three months before operations are resumed. A small force of men will be retained in addition to those on repair work. Both Bell and Diamond properties are operated through one shaft.

NEVADA

Clark County

SOUTH NEVADA GOLD MINING CO. (Los Vegas)—Recently completed mill has been thoroughly tested and is working satisfactorily. Four more Beers type roller mills will be added to equipment, doubling capacity of plant. Iron and timber for addition to building have been ordered.

Esmeralda County

ATLANTA (Goldfield)—Oreshoot, believed to be downward extension of Goldfield Consolidated vein, has been cut on 1750-ft. level. Vein is 9 ft. wide, of which 5 ft. assays $27 and 2 ft., $41.

Humboldt County

PLACER STRIKE IN KINGS RIVER VALLEY, 80 miles north of Winnemucca, has been made, it is reported. Many have left for that district from National.

FEDERAL MINES CO. (Unionville)—Dredge is digging 1500 to 1600 cu.yd. per day. This dredge has 5½-cu.ft. buckets, and gasoline is power used. If electric power were available, capacity of dredge could be greatly increased. This is the only dredge operating in Nevada.

PEERLESS NO. 6 (Rocnester)—Controlling interest in this claim has been acquired by F. W. Kittle, of Salt Lake,and Rochester Peerless Mines Co. has been organized. Development work will be done on large scale, and if ore developed justifies, milling plant will be built.

Lander County

PLACER MINING is now being done in Copper Cañon, Copper Basin, Willow Creek, Box Cañon and Long Creek. Considerable high-grade gravel has been washed and nuggets worth up to $150 have been found.

NEVADA PACKARD MINES CO. (Rochester)—Deal has been made with G. S. Johnson Co., of San Francisco, to furnish capital for development of mine and construction of mill.

Lyon County

EMPIRE NEVADA (Yerington)—Fifth churn-drill hole has been started. This prospecting is being done by Miami Copper Co.

NEW YERINGTON (Yerington)—This property is now being operated by lessee. First shipment of copper ore was made recently.

NEVADA-DOUGLAS (Ludwig)—Development in Casting Copper ground and diamond drilling in Ludwig mine are progressing with satisfactory results. Work on designs for new leaching plant is still in progress.

Mineral County

MINT (Rawhide)—Work on this lease will be resumed in near future.

AURORA CONSOLIDATED (Aurora)—An option on this property has been granted to Goldfield Consolidated Co.

Nye County

CORNUCOPIA (Manhattan)—Large vein has been discovered by surface trenching.

GOLD MOUNTAIN MINING & DEVELOPMENT CO. (Bonnie Clare)—Two groups, Royal Flush and Texas Kelly, are being worked. Ore is transported to mill by recently installed 5-ton motor truck, at one-third cost of teaming. Mill is making saving of 85% on $12 gold ore.

CARRARA MINING & MILLING LEASING SYNDICATE (Carrara)—Mill is now finished and will be in operation in a short time. Equipment consists of a 7x9-in. Dodge crusher, one 6-ft. Wallace mill of chilean type, silver-plated copper plates, amalgam traps, and stationary canvas tables. Automatic feeders and belt conveyors are used. Tailings are stacked by bucket elevator, pending future cyanidation. Motive power is furnished by 30-hp. Commercial gasoline engine.

Storey County

SIERRA NEVADA (Virginia City)—Sinking of winze in northeast drift on 2500 level has been started, first round below collar set showing rich streak, 15 in. wide. The 400 ft. of ground between the 2500 and 2900 has never been prospected.

OPHIR (Virginia City)—Hardy vein on 2350 level is being followed west, where a rich streak of ore, several inches wide, continues to be exposed in face of drift. Entire material in vein breaks to $12 and $15 ore. East vein on this level, now shows a width of 6 ft., with low-grade ore being saved. Shipments of accumulated ore are being made to Kinkead mill and cyanide plant, and stoping in ore will soon be underway.

CROWN POINT-BELCHER INCLINE—Results of pumping operations at this point in lowering water from 1400 to a point below 1600 station of incline, are beginning to show in all of surrounding properties. Drainage of entire country following pumping out of incline has been more or less slow, but water at Yellow Jacket incline shaft to north is now below 1500 station, and at a corresponding depth in Overman shaft to south.

White Pine County

BOSTON-ELY (Ely)—Crosscut on 1100-ft. level of Emma shaft, being driven to cut oreshoots exposed on surface at lime-porphyry contact, has been advanced 1386 ft. It is expected that shoot will be cut in about 60 ft. Stringers of ore in lime bedding planes have been cut.

NEVADA CONSOLIDATED (Ely)—It is stated that churn-drill prospecting will be resumed on property west of Lane City and east of Ruth mine. It is believed that deep prospecting in Veteran mine will also discover oreshoots on same contact where they occur in properties to north and south.

NEW MEXICO

Eddy County

ARTESIA COPPER MINING CO. (Artesia)—Company has been organized to develop a copper property which has been discovered 12 miles east of Artesia.

Grant County

PHELPS-DODGE (Tyrone)—Work is progressing fast on grading for mill. Construction work is being rushed on experimental plant.

EMPIRE ZINC CO. (Pinos Altos)—Company is pushing development work and new shaft is being started. Large force of men now employed.

EIGHTY-FIVE MINE (Lordsburg)—Grand jury in Silver City returned verdict in favor of plaintiff in suit of W. T. Scarborough vs. Eighty-five Mining Co., adversing claim for Eighty-five group of claims in Virginia district.

LUCKY BILL (Vanadium)—Property has been sold by owners Paul Larsh and T. J. Ross to J. A. Meiserhoff and William Schoen, of Milwaukee. Purchase price reported to have been $25,000 cash. Mine has been a good producer of lead carbonate and is largest producer of vanadium in southwest. New owners will develop and work on large scale.

Socorro County

PACIFIC MINES CO. (Mogollon)—Shaft has been sunk 100 ft. below third level. High-grade stope below 250-ft. level continues to yield best ore now being mined in camp.

NEW YORK

Onondaga County

GYPSUM MINING AND PREPARATION for market is quite an extensive industry in central and western New York. Total value of gypsum products in state for 1912 was $1,186,845, as compared to $1,092,598 in 1911. Output of crude rock was 506,274 tons, largest total on record, next largest being in 1910, when it was 465,591. Gypsum is obtained both from mines and quarries. Most of the crude rock is made into stucco and wall plaster in plants near mines, where it is milled and calcined, although some companies ship raw gypsum to portland-cement plants of New York, Pennsylvania and New Jersey. Little crude product also goes to plate-glass manufacturers, and to agricultural users. Due to use as wall plaster, output varies with activity in building trades. Counties producing are Onondaga, Monroe, Genesee and Erie. Central New York deposits in Onondaga County have been declining in importance, due to a falling off in demand, and western New York plants have been increasing their business. Following companies are active: Cayuga Gypsum Co., Unioh Springs; Niagara Gypsum Co., Oakfield; U. S. Gypsum Co., 205 Monroe St., Chicago, Ill.; American Gypsum Co., Rochester; Empire Gypsum Co,, Rochester; Consolidated Wheatland Plaster Co., Caledonia; Lycoming Calcining Co., Williamsport, Penn.; E. B. Alvord, Jamesville; Thomas Millen & Co., Jamesville.

UTAH

Juab County

TINTIC SHIPMENTS for week ended Mar. 13 were 159 cars; those for week ended Mar. 20, 162 cars.

SELMA (Eureka)—An electric hoist and four drill compressors will soon be installed at this property in North Tintic. Shaft is down 210 ft. and will be sunk to 400 level.

EAGLE & BLUE BELL (Eureka)—Orebody recently cut on 1550 level has been found to continue below it, and chances of opening a good body of ore appear favorable. Deposit was opened 250 ft. from shaft. It has been drifted on for 40 ft.

EUREKA HILL (Eureka)—Large tailings dump at this property has been sampled by prospective lessees. There is a possibility of reopening mine, which has been inactive for last two years, except for leasing operations. Low-grade ore left in early days may be handled at a profit under present conditions.

GOLD CHAIN (Mammoth)—Work of installing new equipment which has recently interfered with mining is nearly completed. A donkey hoist 600 ft. northwest of shaft on 1000 level will be used for mining ore opened on 1100 and 1200. Copper ore was shipped recently from 700, where dead work has been finished.

YANKEE (Eureka)—A car of high-grade zinc ore and one of silver-lead ore have recently been shipped. Prospecting is being done on 1700, east and west, west drift following a large quartz vein. Crosscutting on upper levels in search of northern extension of Beck Tunnel-Colorado ore zone is in progress.

MAY DAY (Eureka)—Strike of silver-lead ore made recently by lessees on upper levels has produced seven cars. Ore has been followed about 100 ft., and a good showing continues. Griggs-Carter-Castleton cyanide mill at Knightville is being put in shape for resuming operations. Up to 60 tons per day have been treated.

CHIEF CONSOLIDATED (Eureka)—A drift into Eureka City section on 1400 is approaching Beck fault. Drifting along this will be done. Deposits thus far opened in Eureka City territory have been offshoots from main ore channel, but larger bodies are expected. Output for week ended Mar. 20 was 24 cars, some of the ore coming from 1600. Vein on this level is not as large as above, but ore appears to be of higher grade.

Piute County

BEAVER MINES (Marysvale)—Contracts for tunneling and drifting have recently been let. Tunnel is being driven for Copper Belt vein, which is expected to be reached within 80 feet.

BULLY BOY (Marysvale)—Development work is being done at this property in Bullion Cañon, and ore has been blocked out. It is expected that milling operations will be started May 1. Some mill ore assays $10 per ton. One tunnel is in 4600 feet.

Summit County

PARK CITY SHIPMENTS for week ended Mar. 20 amounted to 2,894,660 lb., by four shippers.

DALY WEST (Park City)—Annual report for 1913 shows receipts from ore sales to have been $406,705. A total of 60,788 tons of ore was mined, of which 1555 dry tons was first-class and 59,233 milling ore. Crude ore amounting to 5038 tons sold for $70,980; 8332 tons of concentrates brought $314,058, and 1598 tons of zinc concentrates sold for $21,666. Total disbursements were $434,296, of which $320,879 were from mining expense, $85,693 for mill account, remainder being for assay office and general expense. At beginning of the year, cash on hand amounted to $109,868, with $23,648 on hand at the close. One dividend of $27,000 was paid, and $18,537 expended for the purchase of property. This included Diamond Nimrod claims, and stock in West Ontario Consolidated Mining Co. During 1913 mill ore averaged 5% lead, 7.7 oz. silver, and 4.3% zinc. Lead concentrates carried 34% lead, and 40 oz. silver, while zinc concentrates carrying 35% zinc were made. Milling costs were 86½c. per ton. Mill and hoisting plant were destroyed by fire, Dec. 28, and property is stated to be in condition to warrant rebuilding. New hoist and mill should be completed by September, 1914. Insurance on property destroyed has been collected, and will nearly, if not entirely, pay costs of rebuilding. Company owns stock in Little Bell, Silver Lake Water Co., Thompson-Quincy and West Ontario mining companies, and has a tunnel contract with Ontario and Daly.

Utah County

SANTAQUIN KING (Santaquin)—Ore carrying lead and silver with an excess of iron has been opened in a fissure on tunnel level. Development and raising on fissure will be done.

MILLER (American Fork)—Wadley lease has several hundred sacks of lead-silver ore on dump ready for shipment. Ore makes on limestone bedding, and is near ground from which a good body of ore was mined by the Tyngs.

WASHINGTON

Ferry County

A SHIPMENT TO HONG KONG of 500 tons of copper ore left Seattle recently on a "Blue Funnel" liner. It will be consigned to various European ports. This is largest shipment of its kind ever made by sea from this port.

LAURIER—This mine has been closed down to install a tram.

BEN HUR—Company is shipping 150 tons of ore daily to smelter; returns are satisfactory.

LAKE VIEW—Company has been incorporated by J. P. Chandler and others to develop property near Plerre Lake.

MOGUL (Rockcut)—A strike of high-grade ore was recently made. Considerable development work is planned for this season.

PHOENIX (Curlew)—Company is making a good showing on its 19 claims. Ore assaying $38 in silver, gold and copper has been opened.

REPUBLIC MINES CORPORATION (Republic)—This property was bid in for $262,000 for a New York syndicate represented by R. A. Sterling.

IRON CREEK—Company is hauling ore to Republic, a distance of 40 miles, from where ore is shipped to Trail, B. C. W. J. Hall and C. T. Hill are owners, and despite long haul expect to make good profit. Returns will be used in further developing property.

Okanogan County

GOLD LEAF (Chesaw)—Property has been leased for one year to William Plunkett. Ore carries gold.

LADY OF THE LAKE (Conconnully)—Ore assaying up to $40 per ton has been found at this property at Conconnully, owned by George Hardenburg, of Chelan. Improvements are to be made.

CANADA

British Columbia

GRANBY (Anyox)—Hidden Creek smelting works blown in Mar. 16; first copper poured Mar. 18.

MOUNT IDA (Salmon Arm)—A small force of men has been engaged for several months extending tunnel with result that 280 ft. in a large shoot of ore has been struck.

HARRIS (Hazelton)—First shipment of copper ore from this property, consisting of 40 tons, has just been made to a coast smelter. A spur of Grand-Trunk Pacific Ry. is being built to property and it is expected to become a regular shipper.

IRON CAP (Sheep Creek)—Shipments have recently started from this group, owned by George E. Revell and associates. Considerable ground sluicing was done last year and sufficient sinking on a shoot was done to get out a trial shipment to the Trail smelter.

Ontario

OTISSE (Cobalt)—Shareholders have voted to wind up company's business.

RIGHT-OF-WAY (Cobalt)—A new vein of 3000-oz. ore has been cut on 120-ft. level.

JUPITER (South Porcupine)—Purchase by McKinley-Darragh was ratified at annual meeting.

KERR LAKE (Cobalt)—It is announced that this company has purchased control of Hollinger Reserve.

GOLD REEF (Porcupine)—A shareholders' meeting is to be called to discuss an offer for sale of the property.

PETERSON LAKE (Cobalt)—Two officers of company are in London and it is stated that a deal for property is being negotiated.

KING EDWARD (Cobalt)—York Ontario which has a lease on this property, has raised sufficient money to sink shaft to 1100 ft., at which depth, it is expected to cut the contact between the diabase and the Keewatin.

BEAVER (Cobalt)—New electric hoist which will permit mining to a depth of 1000 ft., has been placed in position. Company will now be able to operate two lower levels, on which they were forced to cease work some time ago, due to a lack of hoisting capacity.

HOLLINGER (Timmins)—Report for four weeks ended Feb. 25 shows profits of $111,679 as compared with $101,633 for preceding period. Mill treated 10,042 tons, averaging $17.50. Of this amount 239 tons were for Acme Gold mines. Extraction was 97.4%. Net surplus now stands at $721,805. Total operating costs were $5.52 per ton.

SENECA-SUPERIOR (Cobalt)—Second annual report shows production in 1913 of 1,085,744 oz. Ore reserves are estimated at 3,460,000 oz., showing an increase of 2,400,000 over preceding year. Gross value of ore production after deducting royalties, freight and insurance, was $452,080; net profits, after deducting all charges, were $288,626, from which dividends to amount of $263,136 were paid; operating expenses were 12½c. per ounce.

MILLER-LAKE-O'BRIEN (Cobalt)—Company has recently installed hydro-electric equipment and will soon be operating altogether by electric power. Good ore has been found on 450-ft. level, and a new vein carrying high-grade ore has been uncovered on surface, 1000 ft. from present shaft. On Millerett property, owned by Miller-Lake-O'Brien, development has been satisfactory and company claims to have $500,000 worth of ore in sight.

The Market Report

METAL MARKETS

NEW YORK—Apr. 1

The metal markets have not varied greatly during the week. Business generally has been rather slow. Exports of copper continue large, forming the greater part of the business.

The New York Metal Exchange elected the following officers at its annual meeting on Mar. 30: President, A. B. Hall; vice-president, Edwin Groves; treasurer, Robert L. Crooks. Managers, H. W. Hendricks, Emil Baerwald, W. Parsons Todd, Erich Benjamin, L. Vogelstein, Julius Loeb, Charles S. Trench and Edward W. Starke. Arbitration Committee, P. R. Jennings, J. H. Lang, Charles J. Marsh, Edwin J. Keane and C. M. Loeb.

Copper, Tin, Lead and Zinc

Copper—The market has been extremely quiet, consumers both in Europe and this country holding aloof on account of the pessimism that prevails. On the date of our last report the principal producers, having sold copper at 14½c., delivered, usual terms, advanced their asking price to 14⅝c. They maintained that asking price during the last week, being well sold ahead and consequently indifferent to the slackness of demand, but so far have failed to realize it. The business done was chiefly by second hands and at lower figures. Toward the close of the week a decidedly better feelig became apparent and on Apr. 1 sales were made as high at 14½c., delivered, usual terms, with an expectation generally prevailing that the asking prices of the principal producers would shortly be realized. The average of quotations for the last week is 14.26 cents.

No business worth mentioning is reported as having been done in Lake copper, quotations for which are but nominal.

The London standard market hung around £65 for spot and £65 10s. for three months until Wednesday, April 1, when the market became active and prices advanced, closing at £65 12s. 6d. for spot and £66 for three months prompt.

Base price of copper sheets is now 19¾c. per lb. for hot rolled and 20¾c. for cold rolled. The usual extras are charged and higher prices for small quantities. Copper wire is 15@15½c., carload lots at mill.

Exports of copper from New York for the week were 10,833 long tons. Our special correspondent reports exports from Baltimore for the week at 2666 tons.

Tin—Holders of the metal in this market showed great anxiety to dispose of their stocks, not only by offering it at concessions at home, but also by placing selling orders on the London Metal Exchange. The result is a rather weak market, with almost a total absence of consumptive demand. The price, which prior to the Banka sale on Mar. 26, was marked up, declined from day to day and closes at £172 12s. 6d. for spot and £174 7s. 6d. for three months, and about 37⅞c. for April tin here.

Messrs. Robertson & Bense report the arrivals of tin ore and concentrates at Hamburg, Germany, in February, at 1760 tons, of which 1710 tons were from Bolivia and 50 tons from Japan.

Exports from Baltimore for the week ineluded 428,840 lb. scrap tin to London and 259,012 lb. to Antwerp.

At the Banka auction sale on Mar. 26 there were 2400 tons of tin sold at prices that were equivalent to £181, c.i.f. London—an unusually high price.

A United States consular report gives the exports of tin from Hongkong in 1913 at 77,412 slabs—3871 long tons—of which 36,790 slabs went to the United States. This is a decrease of 38,663 slabs in the total, but an inerease of 9237 in shipments to the United States. The output of Vunnan tin was about 10,000 tons in 1912; in 1913 probably 13,000 tons, although kept down by local disturbances.

Lead—Following the eut of the A. S. & R. Co. on Mar. 25, the market became 3.90c., New York, but was weak at that. On Mar. 30, the A. S. & R. Co. made another eut, this time to 3.80c., New York. The lower figures interested buyers and led to the doing of more business, some round tonnages figuring in the transactions. This led to a little stiffening of the market at St. Louis on Mar. 31 and today.

The London market has also declined, Spanish lead being quoted £18; English lead £18 12s. 6d. per ton.

Spelter—The market has been a little more aetive, with some business reported at slightly better figures. In the early part of the week sales were reported at 5.07½@5.10c., but during the latter part there were transactions at about 5.10c. Bids of 5.10c. are reported as having been turned down, but in such cases there were probably special reasons governing, spelter being offered to consumers at 5.10c.

At London, good ordinaries are quoted £21 12s. 6d.; specials 10s. higher.

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

DAILY PRICES OF METALS

NEW YORK

Mar.-Apr.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
26	4.8625	58	14½ @14½	14.25 @14.35	38⅜	3.90	3.75	5.22½ @5.25	5.07½ @5.10
27	4.8620	58	14½ @14¾	14.20 @14.25	38¼	3.90	3.75	5.22½ @5.25	5.07½ @5.10
28	4.8615	58	14⅝ @14⅝	14.20 @14.25	38	3.90	3.75	5.22½ @5.25	5.07½ @5.10
30	4.8615	58	14⅝ @14⅝	14.15 @14.25	37⅞	3.80	3.65 @3.70	5.22½ @5.27½	5.07½ @5.12½
31	4.8615	58	14⅝ @14⅝	14.25 @14.35	38	3.80	3.67½ @3.70	5.22½ @5.27½	5.07½ @5.12½
1	4.8615	58⅛	14⅝ @14¾	14.30 @14.35	37⅞	3.80	3.67½ @3.70	5.22½ @5.27½	5.07½ @5.12½

*Nominal.

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

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

LONDON

Mar.-Apr.	Silver	Copper				Tin		Lead		Zinc	
		Spot		3 Mos.	Best Sel'td	Spot	3 Mos.				
		£ per Ton	Cts. per Lb.					£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
26	26⅛	65	14.12	65⅜	69⅜	174¾	176¼	19¼	4.18	21⅜	4.64
27	26¼	64⅞	14.09	65 5/16	69½	174¼	176⅛	19 3/16	4.17	21½	4.67
28	26¼	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	26⅜	64¾	14.07	65 3/16	69½	172½	174½	18⅞	4.10	21⅜	4.64
31	26⅜	65⅛	14.15	65½	69½	173⅛	174⅞	18¾	3.96	21⅜	4.64
1	26 11/16	65⅝	14.26	66	69⅞	172⅝	174⅜	18	3.91	21⅜	4.70

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latte being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21¾c.

Other Metals

Aluminum—The market remains quiet. Sales are small and what business may be going is sought after. The current quotation is 18@18½c. per lb. for No. 1 ingots, New York.

Antimony—Business is quiet and prices unchanged, at 7.25 @7.50c. per lb. for Cookson's; 7@7.15c. for Hallett's; 5.90@ 6.15c. for Chinese, Hungarian and other outside brands.

Quicksilver—Business is fairly active with sales good. New York quotations are $38 per flask of 75 lb. for large lots, and 54c. per lb. for jobbing orders. San Francisco, $38 for domestic orders and special terms for export. London price is now £7 per flask, with £6 7s. 6d.@£7 asked by second hands.

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

Exports and Imports of Metals in the United States, month of January, as reported by the Bureau of Statistics, Department of Commerce:

	Exports		Imports	
Metals:	1913	1914	1913	1914
Copper, long tons	32,323	38,021	18,567	15,803
Tin, long tons	35	52	3,488	3,485
Lead, short tons	2,969	1,363	10,579	1,295
Zinc, short tons	170	258	5,302	149
Nickel, lb.	3,188,877	3,501,505	4,697,110	3,831,075
Antimony, lb.	19,130	.....	2,296,501	1,531,951
Aluminum, lb.	5,507	.....	3,179,774	1,231,536
Quicksilver, lb.	10,006	907	.....	.....
Platinum, oz.	.....	.....	12,875	6,817
Ores, etc.				
Zinc ore, tons	1,530	.....	6,904	949
Zinc in ore, lb.	.....	.....	8,700,403	770,414
Zinc dross, lb.	48,690	80,014	.....	.....
Zinc dust, lb.	14,800	6,570	352,715	332,435
Zinc oxide, lb.	2,132,405	2,640,435	.....	.....

Copper, lead, nickel and antimony include metallic contents of ore, matte, etc. Quantity of antimony ore is not reported. Exports include reëxports of foreign material. In addition to the metallic aluminum given above, manufactures of aluminum were exported to the value of $69,903 in 1913 and $109,565 this year.

Gold, Silver and Platinum

Gold—The demand for gold on the open market in London was so strong at the beginning of the week that a premium of ⅛d. was paid, making the price 77s. 9⅛d. per oz. The demand was chiefly from Russia and France, but Germany also took some gold. After the weekly arrivals from the Transvaal had been taken, the premium was dropped.

Gold receipts at the Australian Mints in January were: Sydney, 56,681 oz.; Melbourne, 45,372; Perth, 125,542; total, 227,595 oz. All the gold was of Australian origin, except 515 oz. from Papua.

Iridium—The price remains about the same as for several weeks, dealers asking $75@78 per oz., New York.

Platinum—The market is inclined to be quiet but is steady and no change is noted. Dealers ask $43@44 per oz. for refined platinum and $46@49 for hard metal. There is talk of a speculative advance abroad but none has yet been made.

Our Russian correspondent writes under date of Mar. 18 that the market is rather strong but with no special animation. There is about the usual demand and metal offered is promptly taken. Some tendency to higher prices is reported, but there has been no actual change. Quotations for crude metal, 83% platinum, remain 9.65 rubles per zolotnik at Ekaterinburg and 37,150 rubles per pood at St. Petersburg—equal to $36.28 and $36.41 per oz., respectively. Preparatory work at the Ural placers has been started. There will be a considerable increase in the work done by dredges this season.

Silver—The market has continued remarkably steady. Within the last week the price has been stationary at 26¾d., at which figure supplies have been sufficient to meet the demand. The market, however, continues firm, and it would seem as if the bidding price must move higher if any considerable quantities of silver bullion are required either for the Continent or the Orient.

Shipments of silver from London to the East, Jan. 1, to Mar. 19, as reported by Messrs. Pixley & Abell:

	1913	1914	Changes
India	£1,994,000	£1,527,000	D. £467,000
China	95,000	40,000	D. 55,000
Total	£2,089,000	£1,567,000	D. £522,000

Receipts continue light, owing to the small supplies from Mexico. Available stocks of silver in London and the East are, it is estimated about 8,000,000 oz. less than at the beginning of the year.

Zinc and Lead Ore Markets

JOPLIN, MO.—Mar. 28

Zinc blende sold as high as $43.50, the assay base ranging from $37.50@40.50 and the metal base from $37@39 per ton of 60% zinc. Calamine sold at $19@23 per ton of 40% zinc. The average price all grades zinc is $37.68 per ton. Lead declined $2 per ton on week-end purchases, though the larger part of the shipment was made early in the week on last week's prices. The high price is unchanged at $53, and the average of all grades is $48.62 per ton.

Shortage of cars on one line of railroad kept down the shipment, despite heavy buying. Weather conditions are good for outputting, but the declining price of lead and an uncertain feeling concerning the zinc market is depressing the production of ore.

SHIPMENTS WEEK ENDED MAR. 28.

	Blende	Calamine	Lead	Value
Total this week	9,182,770	812,680	1,892,290	$234,450
Total 3 months	132,358,040	8,037,790	23,406,640	$3,354,515

Blende value, the week, $178,835; 3 months, $2,675,360.
Calamine value, the week, $9520; 3 months, $91,685.
Lead value, the week; $46,095; 3 months, $587,380.

PLATTEVILLE, WIS.—Mar. 28

The base price paid this week for 60% zinc ore was $40 per ton. No sales of lead ore were reported.

SHIPMENTS WEEK ENDED MAR. 28

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	2,869,400	.....	1,130,340
Year	37,421,850	1,181,100	12,906,810

Shipped during week to separating plants, 3,817,920 lb. zinc ore.

IRON TRADE REVIEW

NEW YORK—Apr. 1

The iron and steel markets are still inclined to be slow. Everyone is waiting to see whether the predicted upward turn in April will materialize.

Structural steel is still the most active section and more orders have been reported. The large demands for subway and elevated work in New York, and for municipal works in other cities have kept up this kind of work. In other lines there is little new to report. Specifications seem to be coming in better than new orders. It is said that the agricultural-implement people are rather slow in their specifications for plain bars. There seems to be an unusual demand for steel bars for reinforced-concrete work.

Railroad orders continue slow, and the car shops will soon be short of work unless there is a change. Rail orders for 1914 are also rather slow in coming forward.

Pig iron is rather at a standstill. The furnaces are trying to hold the latest advance in prices, but buyers are slow and orders are generally small, limited to immediate needs. A sale of 4000 tons Alabama foundry was recently reported, to go to Australia.

PITTSBURGH—Mar. 31

The iron and steel trade continues in a waiting attitude. The advance of the season has brought no increase in bookings. While the rate of the past three or four weeks is maintained, this rate is below the rate of production, and curtailment in output is beginning.

In some directions steel prices are weakening, particularly in the case of bars, plates and shapes, ordinary orders going at 1.20c., while desirable orders usually bring concessions.

Sentiment in Pittsburgh steel circles has become less favorable in the past week, and most branches of the trade are decidedly blue. Tinplate follows its rule of standing alone, and presents an extremely favorable position. Production in the first three months of the year has probably made a new record in tonnage for such a period, while the mills are now running full. The sheet mills have lost a little ground in their rate of output. In tubular goods specifications have been fairly good. In bars, plates and shapes the market is dull. There is no rail market at all. While car orders this year total 30,000 to 35,000 cars, a poor but not altogether a bad showing, all other railroad material is absolutely stagnant.

Pig Iron—The market is simply marking time, but with indications that an important inquiry would result in price cutting. This occurred with basic iron a few weeks ago, when sales were made at $13, Valley, after the market had advanced temporarily to $13.25. Bessemer, which had been fairly well established at $14.25, Valley, developed a price of $14 last week when a purchase of 1500 tons was to be made. Foundry iron would probably show similar weakness under important inquiry. We quote: Bessemer, $14; basic, $13; malleable, $13@13.25; No. 2 foundry, $13.25; forge, $12.75, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Steel—There is no market. About two months ago the large sellers established a basis of $21 for billets and $22 for sheet bars, for first quarter, with prices $1 higher for second quarter. The first quarter is over and the mills assert the advanced schedule is in force, but there is no inquiry to test the situation. We quote the market nominally at $22 for billets and $23 for sheet bars, at maker's mill, Pittsburgh or Youngstown. Rods are $26@27, Pittsburgh.

IRON ORE

Although the opening of navigation is fast approaching, nothing has yet been done in the way of fixing prices for Lake ore and there has been no buying movement. It begins to look as though this year might be as late as 1909, when there was no buying movement till May, or 1908, when buying began in June. Furnace men look for a reduction of 50c. a ton from last season.

COKE

Coke production in the Connellsville region for the past week is reported by the "Courier" at 364,080 tons; shipments, 369,530 tons. Production of the Greensburg and Upper Connellsville districts was 44,782 tons.

Connellsville Coke—There have been no definite market developments in the past week, but the general tone is easier, following one or two sales at $2 for second quarter by operaters who had been formerly holding out for an advance to $2.10. Prompt furnace coke continues quotable at about $1.90. The agreement in the Pittsburgh coal district to continue the union scale unchanged for two years from Apr. 1 will not help the Connellsville coke market, as some operators had been hoping that in the event of a suspension in the union district they would be able to sell some coal.

Coal Shipments from Nova Scotia for the full year were 5,815,000 long tons in 1912, and 6,235,000 in 1913; an increase of 420,000 tons.

Foreign Fuel Trade of France for the year 1913, in metric tons:

	Imports	Exports	Excess
Coal	18,693,123	1,304,409 Imp.	17,388,714
Coke	3,070,036	230,767 Imp.	2,839,269
Briquettes	1,086,045	207,435 Imp.	878,610
Total	22,849,204	1,742,611 Imp.	21,106,593
Total, 1912	19,866,498	2,320,147 Imp.	17,546,351

Exports are chiefly to Switzerland and Italy; Imports are largely from Great Britain and Germany.

German Foreign Trade in Fuel, month of January, in metric tons:

	Exports	Imports	Excess
Coal	2,817,958	715,955 Exp.	2,102,003
Brown coal	7,960	477,433 Imp.	469,473
Coke	477,469	46,173 Exp.	431,296
Briquettes	204,420	12,507 Exp.	191,913
Total	3,507,807	1,252,068 Exp.	2,255,739

Of the briquettes exported this year 83,248 tons were made from brown coal or lignite.

CHEMICALS

NEW YORK—Apr. 1

The general market shows little change, and the tendency is rather to quietness.

Arsenic—There is no change whatever in the market. The price is practically fixed at $3 per 100 lb., and there is only the usual business doing.

Copper Sulphate—On a fair amount of business the market is steady and unchanged. Quotations remain $4.80 per 100 lb. for carload lots and $5.05 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is good and a fair trade is in sight. Quotations are 2.25c. per lb. for spot and all positions up to June; 2.22½c. for June and later deliveries.

Sulphate of Ammonia—The Comité Centrale des Houillères de France, estimates the production of ammonium sulphate in the world for the past two years as follows, in metric tons.

	1912	1913	Changes
Germany	485,000	550,000	I. 65,000
Great Britain	388,000	420,000	I. 32,000
United States	165,000	193,000	I. 28,000
France	69,000	74,500	I. 5,500
Belgium	47,000	51,000	I. 4,000
Other countries	146,000	161,500	I. 15,500
Total	1,300,000	1,450,000	I. 150,000

Germany and Great Britain are both increasing production rapidly, while the United States is also making a fair gain.

PETROLEUM

Exports of mineral oils from the United States in February were 150,531,433 gal. For the two months ended Feb. 28 the total exports were 291,991,967 gal. in 1913, and 313,824,198 gal. in 1914; an increase of 21,832,231 gal., or 7.5%, this year.

COPPER SMELTER'S REPORTS

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

	November	December	January	February	March
Alaska shipments	3,391,300	3,104,155	2,701,258	1,803,579	.....
Anaconda	25,250,000	25,100,000	24,400,000	21,300,000	.....
Arizona, Ltd.	2,800,000	2,920,000	3,474,000	3,062,000	.....
Copper Queen	7,115,991	9,033,459	8,796,358	6,987,366	.....
Calumet & Ariz.	4,600,000	5,230,000	5,975,000	5,596,850	.....
Chino	4,270,821	4,390,018	.....	.....	.....
Detroit	1,922,352	2,021,034	1,590,681	1,814,214	.....
East Butte	1,002,190	1,324,560	1,256,000	1,193,960	.....
Giroux	250,000	197,649	148,411	90,017	.....
Mason Valley	1,174,000	1,372 000	944.000	.....	.....
Mammoth	1,700,000	1,400,000	1,625,000	1,400,000	.....
Nevada Con.	5,443,647	5,343,862	5,791,122	4,588,243	.....
Ohio	772,120	722,940	700,728	582,000	.....
Old Dominion	2,450,000	2,613,039	2,797,000	3,066,000	.....
Ray	4,753,964	5,075,202	5,705,000	5,432.000	.....
Shannon	1,110,000	1,078,000	.....	904 000	.....
South Utah	225,072	242,362	275,569	333,874	.....
Tennessee	1,666,753	1,700,000	1,474,890	1,232,812	.....
United Verde*	3,000,000	3,000,000	3,000,000	2,700,000	.....
Utah Copper Co.	10,787,426	10,306,646	10,329,564	.....	.....
Lake Superior*	6,600,000	5,600,000	7,400,000	8.500,000	.....
Non-rep. mines*.	6,000,000	6,250,000	6,200,000	.....	.....
Total prod.	96,285,636	98,024,926	.....	.....	.....
Imp., bars, etc.	21,796,866	23,578,938	24,504,249	.....	.....
Total blister	118,082,502	121,603,864	.....	.....	.....
Imp. ore & matte.	8,980,186	12,205,187	10,893,969	.....	.....
Total Amer.	127,062,688	133,809,053	.....	.....	.....
Miami†	3,230,000	3,210,000	3,258,950	3,316,482	.....
Shattuck-Arizona	995,429	1,050,781	1,276,636	1,134,480	.....
Brit. Col. Cos.:					
British Col. Cop.	655,637	.....	.....	.....	.....
Granby	1,944,145	1,605,382	1,793,840	1,661,212	.....
Mexican Cos.:					
Boleo†	2,315,040	2,315,040	2,369,920	1,984.080	.....
Cananea	3,800,000	3,646,000	3,460,000	2,688,000	.....
Moctezuma	3,517,800	3,139,613	3,024,556	2,642,543	.....
Other Foreign:					
Braden, Chile	1,592,000	2,122,000	2,430,000	2,362,000	.....
Cape Cop., S. Af.	649,600	683,200	519,680	459,200	.....
Spassky, Russia.	904,960	900,480	902,720	.....	.....
Exports from					
Chile	7,616,000	10,640,000	5,488,000	6,720,000	.....
Australia	11,200,000	6,720,000	5,712,000	7,952,000	.....
Arrivals-Europe‡	9,107,840	13,787,200	8,599,360	18,354,560	.....

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

STATISTICS OF COPPER

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

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

Assessments

Company	Delinq.	Sale	Amt.
Alpha Derrer, Calif.	Mar. 10	Apr. 10	$0.10
American Copper, Utah	Mar. 9	Apr. 15	0.001
Aurora-Sampson, Ida. post'd.		Apr. 10	0.002
Best & Belcher, Nev.	Mar. 16	Apr. 6	0.05
Blue Bell, Ida.	Feb. 9	Apr. 15	0.003
Caledonia, Nev.	Apr. 7	Apr. 29	0.10
C. & R., Ida., post'd.		Apr. 24	0.005
Confidence			0.10
Demijohn	Apr. 1	Apr. 20	0.0025
Eagles Nest, Nev.	Mar. 20	Apr. 23	0.005
Giant, Ida	Mar. 13	Apr. 17	0.001
Great Copper King, Utah	Mar. 7	Apr. 9	0.001
Great Western, Nev.	Apr. 6	Apr. 28	0.01
Idaho-Montana Ida., post'd.		Apr. 18	0.001
Laclede, Ida.	Mar. 16	Apr. 6	0.003
Liberty, Utah	Mar. 28	Apr. 16	0.01
Mass Cons., Mich.	Apr. 7		1.00
Mono, Utah	Apr. 1	Apr. 18	0.0025
New York, Nev.	Apr. 6	Apr. 27	0.05
O. K. Silver, Utah	Mar. 24	Apr. 11	0.005
Old Colony, Mich.	Apr. 6		1.00
Ophir, Nev.	Apr. 7	Apr. 29	0.10
Samson, Ida.	Mar. 28	Apr. 28	0.002
Tintic-Central, Utah	Apr. 11	Apr. 29	0.005
Tintic-Delmar, Nev.	Mar. 30	Apr. 18	0.002
Tonopah-Panama Pacific, Nev.	Mar. 15	Apr. 16	0.0025
Utah-Arizona, Utah	Apr. 4	Apr. 22	0.0025
Victoria, Mich.	Apr. 15	May 24	1.00
Western Union, Utah	Mar. 31	Apr. 20	0.0025
Wonderful, Ida.	Mar. 9	Apr. 9	0.002

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1912	1913	1914	1912	1913	1914
January	56.260	62.938	57.572	25.887	28.983	26.553
February	59.043	61.642	57.506	27.190	28.357	26.573
March	58.375	57.870	58.067	26.875	26.669	26.788
April	59.207	59.490		28.284	27.416	
May	60.880	60.361		28.038	27.825	
June	61.290	58.990		28.215	27.199	
July	60.654	58.721		27.919	27.074	
August	61.606	59.293		28.375	27.335	
September	63.078	60.640		29.088	27.986	
October	63.471	60.793		29.299	28.083	
November	62.792	58.995		29.012	27.263	
December	63.365	57.760		29.320	26.720	
Year	60.835	59.791		28.042	27.576	

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

COPPER

Month	New York				London Standard	
	Electrolytic		Lake			
	1913	1914	1913	1914	1913	1914
January	16.488	14.223	16.767	14.772	71.741	64.304
February	14.971	14.491	15.253	14.946	65.519	65.259
March	14.713	14.131	14.930	14.625	65.329	64.276
April	15.291		15.565		68.111	
May	15.456		15.738		68.807	
June	14.672		14.871		67.140	
July	14.190		14.563		64.166	
August	15.400		15.904		69.200	
September	16.328		16.799		73.125	
October	16.337		16.913		73.383	
November	15.182		16.022		68.275	
December	14.224		14.904		65.223	
Year	15.269		15.686		68.335	

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

TIN

Month	New York		London	
	1913	1914	1913	1913
January	50.298	37.779	238.273	171.905
February	48.766	39.830	220.140	181.556
March	46.832	38.038	213.615	173.619
April	49.115		224.159	
May	49.038		224.143	
June	44.820		207.208	
July	40.260		183.511	
August	41.582		188.731	
September	42.410		193.074	
October	40.462		184.837	
November	39.810		180.869	
December	37.635		171.786	
Av. year	44.252		206.279	

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

LEAD

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	4.321	4.111	4.171	4.011	17.114	19.665
February	4.325	4.048	4.175	3.937	16.550	19.606
March	4.327	3.970	4.177	3.850	15.977	19.651
April	4.381		4.242		17.597	
May	4.342		4.226		18.923	
June	4.325		4.190		20.226	
July	4.353		4.223		20.038	
August	4.624		4.550		20.406	
September	4.698		4.579		20.648	
October	4.402		4.253		20.302	
November	4.293		4.146		19.334	
Deeember	4.047		3.929		17.798	
Year	4.370		4.238		18.743	

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

SPELTER

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	6.931	5.262	6.854	5.112	26.114	21.583
February	6.239	5.377	6.089	5.227	25.338	21.413
March	6.078	5.250	5.926	5.100	24.605	21.450
April	5.641		5.491		25.313	
May	5.406		5.256		24.583	
June	5.124		4.974		22.143	
July	5.278		5.128		20.592	
August	5.658		5.508		20.706	
September	5.694		5.444		21.148	
October	5.340		5.188		20.614	
November	5.229		5.083		20.581	
December	5.156		5.004		21.214	
Year	5.648		5.504		22.746	

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

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1913	1914	1913	1914	1913	1914
January	$18.15	$14.94	$17.35	$13.23	$18.59	$13.90
February	18.15	15.06	17.22	14.12	18.13	14.09
March	18.15	15.10	16.96	13.95	17.53	14.18
April	17.90		16.71		16.40	
May	17.68		15.80		15.40	
June	17.14		15.40		15.10	
July	16.31		15.13		14.74	
August	16.63		15.00		14.88	
September	16.65		15.04		14.93	
October	16.60		14.61		14.80	
November	16.03		13.91		14.40	
December	15.71		13.71		14.28	
Year	$17.09		$15.57		$15.77	

STOCK QUOTATIONS

COLO. SPRINGS Mar. 31

Name of Comp.	Bid.
Acacia	‡.02½
Cripple Cr'k Con.	‡.006
C. K. & N.	‡.08½
Doctor Jack Pot	.06
Elkton Con.	.46½
El Paso	1.75
Findlay	‡.02
Gold Dollar	.04
Gold Sovereign	‡.02½
Golden Cycle	‡1.50
Isabella	.11½
Jack Pot	.06
Jennie Sample	‡.04
Jerry Johnson	‡.03½
Lexington	‡.003
Old Gold	.01
Mary McKinney	.55½
Pharmacist	‡.01
Portland	1.09
Vindicator	.93½

SALT LAKE Mar. 31

Name of Comp.	Bid.
Beck Tunnel	.04
Black Jack	.06
Cedar Talisman	.01
Colorado Mining	.10
Crown Point	.01½
Daly-Judge	5.00
Gold Chain	.14
Grand Central	.55
Iron Blossom	1.27½
Little Bell	.10
Lower Mammoth	.01½
Mason Valley	‡2.00
May Day	.06
Nevada Hills	‡.33
Prince Con.	.20
Silver King Coal'n	3.15
Silver King Cons.	1.75
Sioux Con.	.03
Uncle Sam	.04½
Yankee	‡.04

TORONTO Mar. 31

Name of Comp.	Bid.	Name of Comp.	Bid.
Bailey	.03½	Foley O'Brien	.28
Conlagas	8.00	Hollinger	16.25
Peterson Lake	.42½	Imperial	.02
Right of Way	.04½	Jupiter	.13
T. & Hudson Bay	71.00	Pearl Lake	.08½
Timiskaming	.15	Porcu. Gold	.11½
Wettlaufer-Lor.	.06	Preston E. D.	.02½
Big Dome	11.00	Rea	.20
Crown Chartered	‡.00½	Swastika	.03
Dome Exten.	.11½	West Dome	.11

SAN FRANCISCO Mar. 31

Name of Comp.	Bid.	Name of Comp.	Bid.
Comstock Stocks		Mise. Nev. & Cal.	
Alta	‡.02	Belmont	7.65
Belcher	.40	Jim Butler	.96
Best & Belcher	.07	MacNamara	.09
Caledonia	.50	Midway	.34
Challenge Con.	.07	Mont.-Tonopah	.97
Chollar	‡.02	North Star	.31
Confidence	.30	West End Con.	.80
Con. Virginia	.12	Atlanta	.31
Crown Point	‡.15	Booth	.06
Gould & Curry	.02	C.O.D. Con	.07
Hale & Norcross	.04	Comb. Frac.	.09
Mexican	1.10	Jumbo Extension	.33
Occidental	.70	Pitts.-Silver Peak	.36
Ophir	.34	Round Mountain	.34
Overman	.15	Sandstorm Kendall	.09½
Potosi	.01	Silver Pick	.07
Savage	.03	Argonaut	‡2.75
Sierra Nevada	.15	Bunker Hill	‡1.90
Union Con.	.10	Central Eureka	.67
Yellow Jacket	‡.44	So. Eureka	‡1.75

N. Y. EXCH. Mar. 31

Name of Comp.	Clg.
Amalgamated	76½
Am.Sm.&Ref.,com.	69½
Am. Sm. & Ref., pf.	102½
Am. Sm. Sec., pf. B.	83
Anaconda	36½
Batopilas Min.	75
Bethlehem Steel, pf.	84½
Chino	41½
Colo. Fuel & Iron	32½
Federal M. & S., pf.	35
Great Nor., ore., ctf	36
Guggen. Exp.	56½
Homestake	119½
Inspiration Con.	18½
Miami Copper	24½
Nat'l Lead, com.	46
National Lead, pf.	106
Nev. Consol.	15½
Phelps Dodge	183
Pittsburg Coal, pf.	92½
Quicksilver, pf.	2½
Ray Con.	22
Republic I&S, com.	24
Republic I&S, pf.	87
SlossSheff'd, com.	30
Sloss Sheffield, pf.	89
Tennessee Copper	35½
Utah Copper	55½
U. S. Steel, con.	63½
U. S. Steel, pf.	109½

N. Y. CURB Mar. 31

Name of Comp.	Clg.
Ariz. Belmont	‡.03½
Barnes King	‡1½
Beaver Con.	.31
Big Four	.10
Boston Montana	7½
Braden Copper	8½
B. C. Copper	1½
Buffalo Mines	1.10
Can. G. & S.	‡.07
Caribou	.70
Con. Ariz. Sm.	9/16
Coppermines Cons.	2 3/16
Davis-Daly	1½
Diam'field-Daisy	.05½
Ely Con.	.05
Florence	.60
Gold Hill Con.	.75
Goldfield Con.	1 7/16
Greene Cananea	.37
Greenwater	.06
Internat. S. & R.	‡106
Kerr Lake	3 1/16
La Rose	1 9/16
McKinley-Dar-Sa.	.75
Mines of Am.	2½
New Utah Bingham	.67
Nipissing Mines	6½
Ohio Copper	⅜
Oro	.15
Puebla S. & R.	2¾
South Utah M&S.	‡.25
Stand'd Oil of N.J.	430
Stand'd Silver Lead	1 3/16
Stewart	1½
Tonopah	6 11/16
Tonopah Ex.	2
Tonopah Merger	.52
Tri-Bullion	¼
Tularosa	7/16
United Cop., pfd.	‡3
Yukon Gold	2½

LONDON Mar. 20

Name of Comp.	Clg.
Camp Bird	£0 12s 0d
El Oro	0 14 0
Esperanza	0 17 6
Mexico Mines	5 5 0
Oroville	‡0 12 0
Santa Gert'dis.	0 16 3
Stratton's	‡0 0 9
Tomboy	1 3 9

BOSTON EXCH. Mar. 31

Name of Comp.	Clg.
Adventure	1¼
Ahmeek	290
Alaska Gold M.	22½
Algomah	1
Allouez	42½
Am. Zinc	18
Ariz. Com., ctfs.	4½
Bonanza	.51
Butte & Balak.	3
Calumet & Ariz.	68½
Calumet & Hecla	415
Centennial	17
Cliff	1
Copper Range	37½
Daly West	2½
East Butte	11½
Franklin	6½
Granby	88½
Hancock	17½
Hedley Gel.	30
Helvetia	.40
Indiana	3½
Island Cr'k, com.	47½
Island Cr'k, pfd.	85½
Isle Royale	18½
Keweenaw	3½
Lake	7
La Salle	4½
Mass.	3
Michigan	.75
Mohawk	43½
New Arcadian	5
New Idria Quick	3½
North Butte	27½
North Lake	1½
Ojibway	1½
Old Dominion	50
Osceola	78
Quincy	61
Shannon	5½
Shattuck-Ariz.	27
Superior	29½
Superior & Bost.	2½
Tamarack	36
Trinity	3½
Tuolumne	.60
U. S. Smelting	38½
U. S. Smelt'g, pf.	47½
Utah Apex	1¾
Utah Con.	10½
Victoria	1 1/16
Winona	3½
Wolverine	45
Wyandot	.60

BOSTON CURB Mar. 31

Name of Comp.	Bid.
Bingham Mines	.05
Boston & Corbin	.35
Boston Ely	.38
Butte & Lon'n Dev.	.37
Cactus	01½
Calaveras	1¼
Chief Cons.	.90
Corbin	.80
Cortez	.25
Crown Reserve	1 13/16
Eagle & Blue Bell	1½
First Nat. Cop.	2½
Houghton Copper	3
Majestic	.23
Mexican Metals	.22
Moneta Porc.	.02
Nevada-Douglas	.84
New Baltic	2
Oneco	1
Raven Copper	.14
Rhode Island Coal	‡.01
Smokey Dev.	.25
So. Lake	3¾
S. W. Miami	1½
Tonopah Victor	.30
Trethewey	.23
United Verde Ext.	.54

‡Last Quotation.

The Mining Index

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