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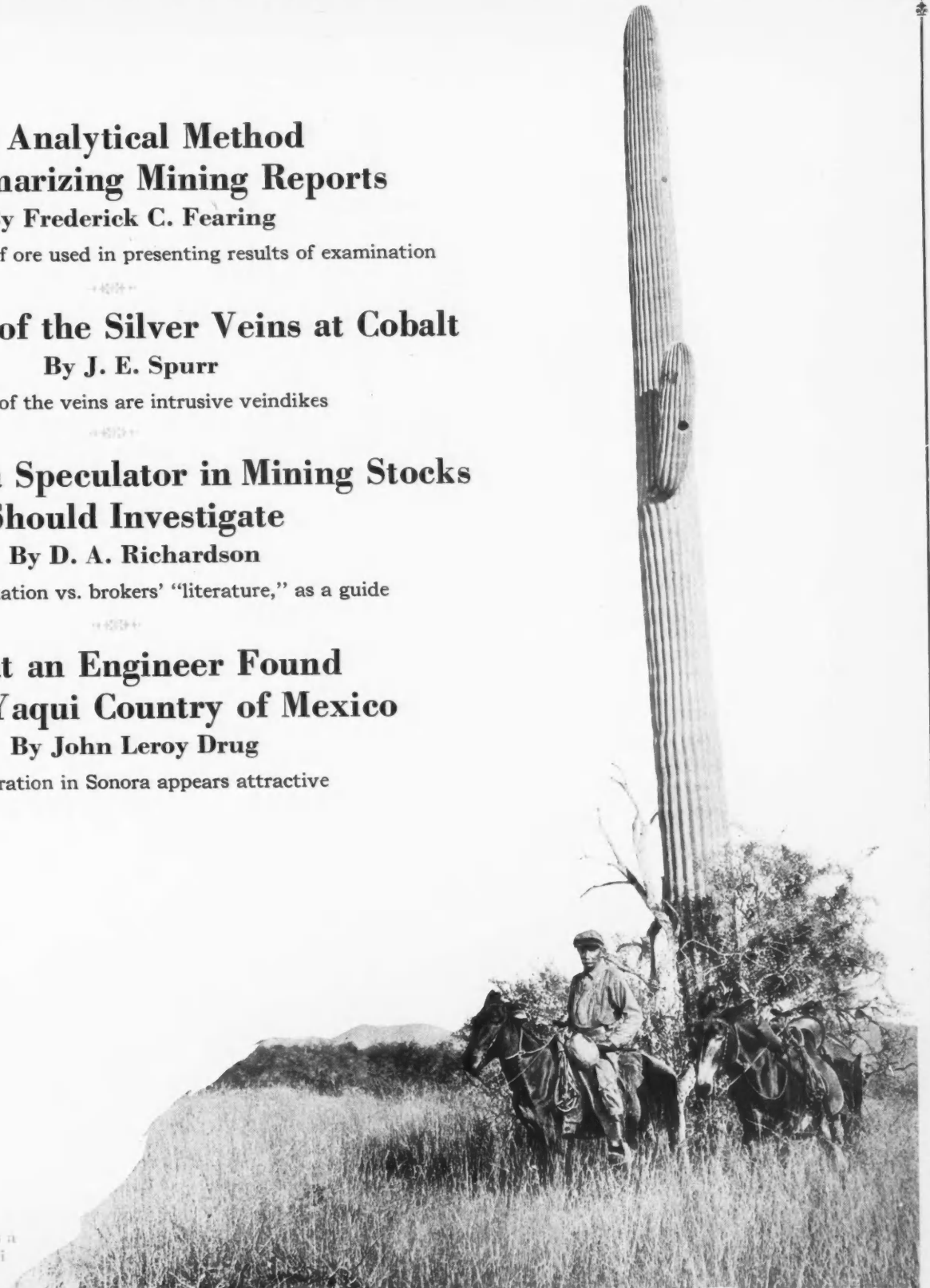
By D. A. Richardson

Real information vs. brokers' "literature," as a guide

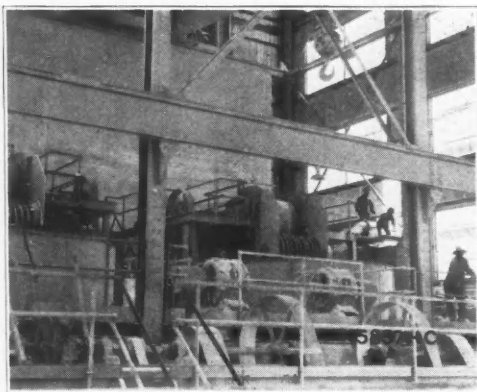
What an Engineer Found in the Yaqui Country of Mexico

By John Leroy Drug

Exploration in Sonora appears attractive



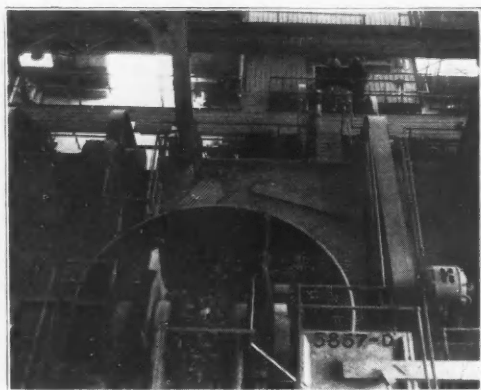
The giant cactus—the silhuaro—is a characteristic feature of the Yaqui country and of parts of Arizona whence our copper comes



General view showing two Burch Grizzlies delivering to crushers.

Since its introduction less than a year ago mining men everywhere, learning of its outstanding advantage — its absolute freedom from clogging — have developed a preference for the

BURCH Grizzly



View looking down over Burch Grizzly into crusher.

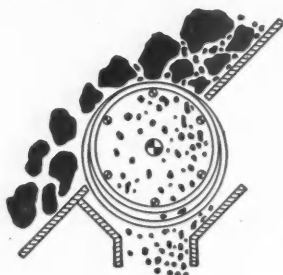
This is a ring-type grizzly that will not clog or jam. Crusher sizes pass over and fines pass through; nothing is ever retained inside the rings.

By a simple arrangement of rings evenly spaced on a revolving frame, the alternating rings being of different diameter, the separation of crusher and non-crusher sizes is accelerated tremendously. The small rings are fixed in position while the large rings swing free. Thus any material that passes the openings at the top meets no resistance on the way through to the receiving hopper or bin.

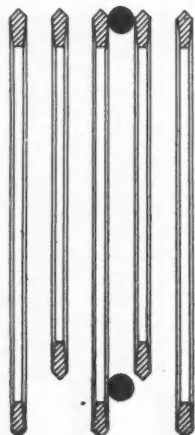
The illustrations show Burch Grizzlies in one of the mills at Bisbee, Arizona. These comprise one of the earliest installations and have given satisfactory service ever since they were put in service.

Burch Grizzlies are built in three standard diameters, 36, 48 and 60 inches, and in any widths up to 10 feet. The ring spacing can be constructed to suit requirements.

Uniform spacing of the rings for accurate separation and increased openings for easy passage of fines.



The over-size is carried over on top the rings. The fines pass thru.



STEPHENS-ADAMSON MFG. CO.
Aurora, Illinois

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JOSIAH EDWARD SPURR, Editor

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Germany and Copper

THE FACT that Germany still continues to be the principal foreign buyer of copper, as well as of cotton and other basic raw materials for cash, from the United States, has recently been the subject of caustic editorial comment in the newspapers, with reference to the ability of Germany to make reparation payments. It has been argued that this ability of Germany to buy goods and supplies largely, and to pay for them, indicated that Germany still possessed great resources, although they were hidden; and that they indicated that Germany could meet her treaty obligations if she wanted to.

On this account we have been interested in a pamphlet by Harold G. Moulton, Director of the Institute of Economics, and Constantine E. McGuire, the pamphlet being a summary of a book entitled "Germany's Capacity to Pay," published under the auspices of the Institute of Economics.

The pamphlet premises "that the economic recovery of Europe is dependent upon the settlement of the reparation issue," and therefore it "undertakes to answer definitely (1) how much wealth Germany has handed over to the Allies, (2) how these payments have been made, (3) whether Germany can pay more now, (4) how can Germany pay more in the future?"

The report sets forth that Germany cannot pay in gold, of which she has only 600,000,000 gold marks; and therefore that the actual payment, whatever the device adopted, can only be made by the export of goods or the rendering of services; that large payments annually can only be met out of the "excess value of finished goods over the cost of producing such goods." The report concludes that Germany has already paid 26,000,000,000 gold marks in fulfilling reparation obligations; but that these payments have been made by the surrender of *capital* values: therefore they cannot be duplicated. As to the favorable trade balance necessary if Germany is to pay reparations out of income, the report shows that her unfavorable trade balance for the four years 1919-1922 amounted to \$10,000,000. As to the bank balances accumulated in foreign countries, it is estimated that they do not exceed 4,000,000,000 gold marks: but it would be disastrous to seize these balances, without which Germany's credit would collapse, and her ability to buy raw materials for her factories.

The possibility of Germany's being able to export more in value than she imports is prevented by the policy of her creditor nations. "The whole world, in fact, seems determined to prevent the expansion of German exports, emergency tariffs, anti-dumping laws, and safeguarding-of-industry acts being striking features of post-war commercial legislation. When in 1921 it looked as if German export trade was about to expand, the entire commercial world was alarmed over the menace of reviving German competition. Summed

up in a single sentence, the reparation problem may be stated as follows: The creditor nations demand that Germany pay; they doubt whether Germany can pay; but if they find that she can, they will prevent her from paying."

The report concludes that Germany's "only hope of economic recovery—and the only hope for reparation payments—lies in the possibility of building up a huge foreign trade." This can only be accomplished if the world is willing to co-operate and to buy. "Implied in this is a driving down of wages and production costs below the level of the world at large, in order that Germany may persistently undersell competitors in world markets. This is the only possible way whereby any substantial exportable surplus can be procured. Whether it is a way that would please and prove profitable to the rest of the world is another story."

The mining industries are vitally interested in this problem. It is necessary for their welfare that Germany should be able to continue to buy copper from us. Probably the greatest selfish interest of the United States is this, for she depends on Germany largely as a customer not only of copper but of cotton and other raw materials. France, on the other hand, is mainly interested in cash payments—or on keeping the Ruhr. There is good reason to believe that she prefers the latter. England is primarily interested in neither, so much as the re-establishment of trade and the economic revival of Europe in general. Under the circumstances France has the upper hand; so that one may guess that Germany will not fulfill her treaty obligations; that she will lose the Ruhr; that a far greater and more powerful French state will be built up; and that in any case Europe will be rent by economic adjustments and political turbulence to which there is no end in sight.

Gold Production in California

CALIFORNIA GOLD PRODUCTION diminished about 50,000 oz. in 1922, as compared to 1921, but increased 17,382 oz. over 1920 production. As compared with 1913, there was a falling off of 277,508 oz. Lode mines recovered their lead over placer and dredging operations in 1922, although in 1921 the latter exceeded the former in gold production by 29,703 oz. As a rule the lode mines overtop the placers and dredging properties in production.

Analyzing the statistics, the three northern counties, Trinity, Shasta, and Siskiyou, showed a smaller gold production by 4,704 oz. in 1922, as compared with 1921, the two figures being 31,494 and 36,198 oz., respectively. The 1913 production was 88,084 oz., indicating a decline of 56,590 oz. for 1922 as compared with 1913. The north central counties, Nevada, Sierra, and Plumas, showed an increase of 75,961 oz. for the year over 1921 and 39,481 oz. over the production made in 1913. This increase was general in all three counties;

Sierra County showed an increase of 55,195 oz. and Nevada County, 16,129 oz. In the former the increase came from the Alleghany district, where rich ore was discovered and increased activity recorded; in the latter county, there was increased activity in the Grass Valley district. The Mother Lode counties, Amador, Calaveras, Eldorado, Mariposa, and Tuolumne, produced 200,409 oz. in 1922 and 199,529 oz. in 1921. The same group of counties produced 255,673 oz. in 1913.

A slow recovery in production is indicated, but present production is materially below former figures. Both the Kennedy and Argonaut mines were shut down for a time and the Kennedy operated at reduced capacity. The southern group of counties, Inyo, Kern, and San Bernardino, produced less gold, the respective figures for 1922 and 1921 being 16,221 and 18,490 oz. The production in 1913 was 60,156 oz. The gold-dredging counties, Butte, Yuba, Sacramento, Merced, and Stanislaus, recorded the greatest decrease, the respective figures for 1922 and 1921 being 214,812 and 334,139 oz., a difference of 119,327 oz. Both Yuba and Sacramento failed to sustain their former production. This was due principally to the working of leaner ground.

The present year promises to be somewhat better than 1922, both in lode and placer mining. It thus appears that gold mining in California is slowly overcoming the handicap of adverse economic conditions. Better labor conditions would at this time play an important part in improving the situation, but industrial, agricultural, building, and state activities continue to upset the labor market and the miners have difficulty in getting and holding suitable labor. However, the total metal value should show an increase in 1923 as compared with 1922.

The Faking of Geological Skill

SOME TIME AGO we called attention to the over-estimation of geological skill which crops up now and then. This had to do with trained and practical geologists, whose own enthusiasm, or more often that of their friends, led them to exaggerate more or less the deeds which they were going to do or had done. Quite a different matter is the counterfeiting of the skill and the training of a geological engineer by one who is not competent. There are all grades of counterfeiting. Some of our bogus twenty-dollar bills are so skillfully made that they are all but as handsome as the genuine, and they are apt to pass current for a long while before being recognized as false and worthless. On the other hand, in the old days when soap companies used to print bills in the shape, color, and rough similitude of greenbacks, with the inscription that they were good for ten cakes of soap instead of ten dollars, they were often accepted as real money by very ignorant people, so that they were forbidden by law. And thus the mining geology of the examining expert may be so little off that his confrères have no desire to call attention to it: or it may be so raw as to be a trap only to the unschooled. Nevertheless, the latter catches the suckers—the small fool investors—as easily as a sound recommendation would.

We have before us, for example, a well-printed even if badly spelled report on the property of the Abundance Mining & Milling Co., of Tinton, S. D., in the Black Hills, by C. D. Berg, of Lead, S. D. An accompanying printed letter by A. J. Johnston, general manager, says he employed Mr. Berg because "Mr. Berg is considered

an authority on the Black Hills geology and its mineralization, and being also a chemist, enables him very closely to determine the merits and possibilities of mining property." Mr. Berg, we are informed, keeps a jewelry store at Lead. Apparently he does not claim to be a mining engineer, because he speaks of them as one apart:

"Mining engineers are apt to call this vertical system fissures, owing perhaps to the fact that these men deal largely with fissures in other mining localities. But I can assure you that in this case there are no fissure veins whatsoever, as the whole country is on edge and in a vertical position on this vertical belt." And he also is virtuously aware that mining engineers are not all they should be. "A wilful evil that has become a common thing is to sample only the country rock, keep away from the ore, and turn the property down." Oh, the excellent Mr. Berg!

But Mr. Berg does claim to be a geologist:

"In reporting on a mining property, and in the Black Hills in particular, my most important duty is to call particular attention to the geological formations on which the property is located, because upon the geological formations, and upon it alone, depends entirely the extent and longevity of the mine.

"It is to be regretted that so many mining engineers in reporting on a mining property have little or nothing to say about the geological formations on which the property is located, owing perhaps to the fact that these men seldom stay long enough in that particular part of the country to learn the formations, their trend, general character, and value."

And, as a geologist, he states in effect that he is able to see into the ground: "We are doing away with much of the wildcatting and hit or miss propositions, we must have something strictly substantial with a future to it to offer the person whose money we are calling for and whom we are more than anxious to see crowned with the greatest success in future operations. As a mine is seldom if ever found to lie on top of the ground, hence the necessity of geological knowledge in locating a permanent mine."

As to the geology in general, "The Black Hills vertical gold bearing iron quartz tremolite belt, running just west of Deadwood and just east of Lead City and the Homestake mine. This great mineralized belt is running continuously through the Black Hills and may be considered as the 'backbone' of the Black Hills ore disposition in the vertical measures on what is known as the vertical belt. It appears to have a great influence on the ore disposition and is generally believed by scientific men to have close relation to the Homestake orebody. The series of this belt has great economic importance and gives great interest and speculation. . . . Now I have given you all this outlining on the Black Hills vertical belt with the one purpose in view, that you may see that, when a pay mine is once developed on this vertical belt and this vertical system of ore bodies, it is a mine established for you and generations to come, and the pay stuff generally increases in value, and the ore bodies get larger with the depth of the exploration, and there are no gash veins or chamber deposits to run out and end the life of the mine."

Besides the gold in the property, which is the chief theme of his report, he refers incidentally to the tin, and here he practically bursts into tears.

"The tin ledges are running systematically between the gold bearing veins and ledges, and the enormous

amount of tin bearing ore that can be seen at the surface can hardly be believed when told, it must be seen to be appreciated, and when you see it you cannot help but ask, "Why is America importing its tin? Why?" And Echo answers, Why? "Summing all this up," he adds, "I would ask can you think of any mining district in the world so well and so richly mineralized as the Tinton district? I cannot. Why is it not developed?" And Echo answers, Why? Still weeping, it would appear, he pens the last sentence of his report, "Our constant cry is who will come over and help us!" It sounds like a call from Europe, whence Mr. Berg evidently hails.

Mr. A. J. Johnston, the general manager, says in the last sentence of *his* letter: "Mr. Berg with his knowledge and experience may be of great assistance to our company in our future operations." What do you mean, operations?

The Depth of Veins

THOUGH it is true that most veins grow poorer in depth, as the distance from the outcrop and the surface increases, this condition is primarily dependent upon superficial influence and secondary chemical reactions dependent upon the oxidation of the atmosphere and of the air contained in the shallow-seated ground waters. Such oxidizing influences, combined with the lowering of the level of the outcrop by erosion, produce, as is well known, a superficial concentration, partly mechanical, largely chemical; and below the enriched oxidized zone, or below the rich secondary sulphide zone which sometimes lies beneath, the richness of the vein decreases so as often to be disastrous to mining.

But if we eliminate this superficial zone of enrichment and confine our thoughts to the primary ores, below the zone of superficial adjustment, it is quite another matter. In some regions the zone of superficial alteration is slight or lacking, so that the primary ore outcrops; in others it is only to be reached at the depth of hundreds of feet. But speaking simply of the primary ore again, it is by no means fair to say that the rule is that the ore grows poorer in depth. Experience indicates that there is no such rule. It is true that all veins or other ore deposits have or had originally a top, bottom, and sides; also that in a vertical sense there is a general central region of greatest value, below and above which the tendency is to taper off. Now, it depends upon the accidental plane at which erosion has exposed the vein at the present surface, whether the surface is above or below the central region of greatest values. The miner can only sink and find out; but he should not be deterred from sinking and finding out by any pessimistic theory that the chances deeper down are not so good.

In some cases the tops of veins, or of the orebodies in the veins, lie at the surface, or even below the surface. That veins do not come quite to the surface when they are formed is shown by the fact that they are lacking in regions of recent volcanism, and even of late Tertiary volcanism where the erosion has been slight. They do not approach nearer than say 500 ft. of the surface when they are formed. If they had come to the surface we should have wonderful ore deposits built up around the outcrops of the fissures up which the ore solution or ore magma came. Only when erosion

reaches this depth of say 500 ft. can the tops of these veins be cut. It follows that the tops of many veins lie not far beneath the present surface, and have not been discovered. Many of these will perhaps never be found. But once in a while the top of a rich vein is found below the surface. The ore in the famous Valenciana mine at Guanajuato, Mexico, did not outcrop. There was only a great vein of barren quartz. A Spanish commercial traveler sunk a prospect shaft in the barren quartz, which was deepened year by year as he little by little secured funds. At a depth of a few hundred feet he broke into the top of the ore, in one of the richest silver veins the world has ever known. The ore went to a depth of about 3,000 ft. before becoming poor; and it is said that the silver from this mine was poured out so rapidly that it had the effect of lowering the price of commodities throughout Europe. This was in the seventeenth century. At another mine in Guanajuato, the Carmen, no vein, even, came to the surface—only a crack in the rock. At a depth of a few hundred feet rich ore, and a vein, came in. The Lamartine mine, near Idaho Springs, in Colorado, had a very large and rich orebody which did not come to the surface. The mine was owned, according to report, by a dentist in Chicago, and some local miners had a contract to sink the shaft for 200 ft. on the barren "lead." The contract having expired, but the contractors being anxious for another profitable contract, they procured some ore from a neighboring mine, and dumped it down their prospect shaft; then sent a sample to their client in Chicago, laconically stating that "this came from the bottom of the shaft." He wired them to keep on sinking, and in a short distance they actually broke into the top of a rich orebody in the vein, which extended downward hundreds of feet.

As a matter of fact, while many mines have been bottomed, nobody has really yet plumbed the depths to which ore will here and there be found. It is probable that in some cases it is very great—very more than the maximum depth of a mile or so already reached, as in Brazil, California, and the Lake Superior region. Miners should, therefore, have no bashfulness about following their ore down and even giving the veins a careful investigation below the point where the ore diminishes in value or disappears, if it should do that. There is no question that many mines have been abandoned too soon.

Labor-saving Devices in Mining

WE HAVE BEEN GRATIFIED at the appreciation expressed by many of our readers, of a recent article on mechanical loading. Indeed, one of the chief problems of the industry nowadays is to substitute machines for hand labor, in order to be able to operate at a profit, or to operate at all. Labor is often actually unobtainable, on account of the restrictions which have been placed on immigration, which have shut off the supply of unskilled labor which has been wont to flow in regularly from Europe. But machines, such as mechanical loaders, are now being developed, under the pressure of this necessity, one of which will do the work of many men. The advantage gained to the industry under this stress will never be lost, whether or not the stress be relieved. Labor-saving devices will and should occupy the attention of mine engineers for a long time yet to come.

The Barranca del Cobre— Mexico's Grand Canyon

By H. H. Taft

Mining Engineer, Almada, Chihuahua, Mexico

"**T**ARARECUA" is the name used by old Spanish writers for what is probably the greatest canyon in Mexico, and next to that of the Colorado the greatest on the continent. Locally it is known as "El Barraoco," "Barranca del Cobre," and the canyon of the Urique River. The word Urique is said to mean canyon in the Tarahumara (Indian) dialect. The canyon is in western Chihuahua and traverses the mining district of San Andres del Rio. It is about 150 miles long and from 2,500 to 5,000 ft. deep.

This canyon has not the wonderful color of the Colorado in Arizona, but nevertheless it is of most unusual and interesting appearance. The "minerales" only are colored yellow and red; the tuffs are gray. The vegetation changes from the pine forests on top through oak into the scrubby and thorny growth of the hot and dry semi-tropics. Apples and peaches on the mesas, oranges and peaches in the canyon.

Urique, a little below the canyon and on the river, dates back to 1630 as a mining region and is said to have produced \$350,000,000 in silver. At the mouth of the canyon is Guadalupe. Ten or fifteen miles up is Uruquillo, and about as much farther is San Antonio del Rio, where the second hypo leaching plant in Mexico was erected. The Cornish boilers lie there yet. The only mine extensively worked in modern times is the Barranca del Cobre, well up the canyon. This was first opened as a gold mine about 1870, sold to the English in 1890 for \$210,000, and operated unsuccessfully as a copper mine until just before the revolution.

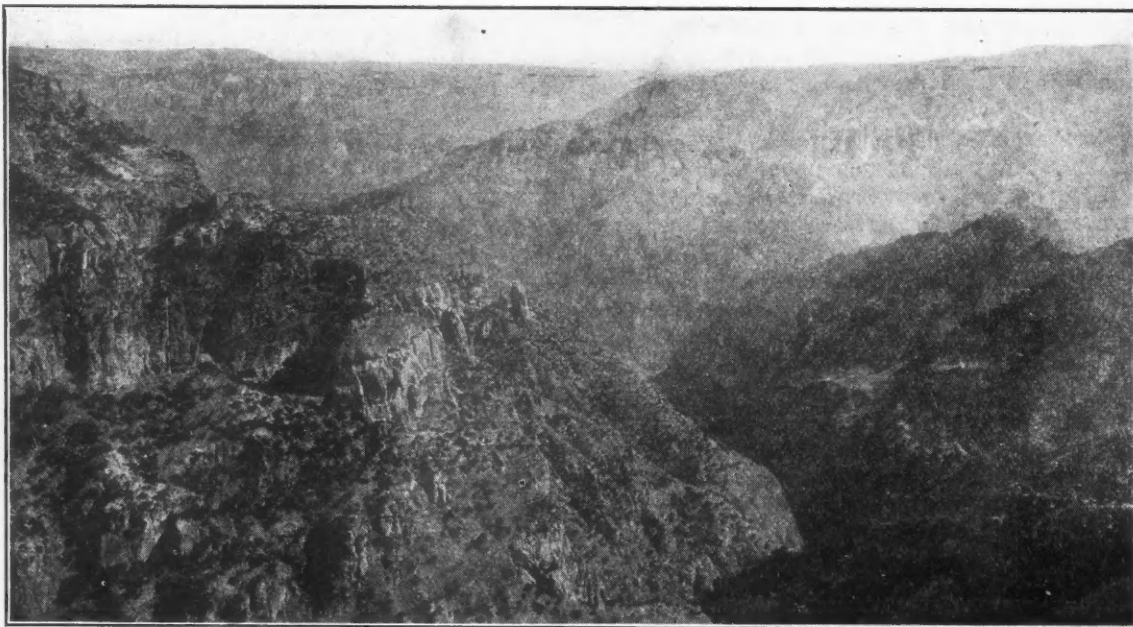
In two instances there are reports that would seem authentic of gold mines having been worked by the Spaniards but now lost. One is in or near the ranch of Napinori; here there is a large area of highly colored and mineralized andesite. There are two similar regions above the Barranca del Cobre and in one of

these is supposed to be a tunnel with an iron door. Not infrequently, rich specimens of both gold and silver ores are brought in. The natives, Tarahumari Indians, have a superstition that if they show a mine to anyone they will surely die.

On the mesa south of the bend in the canyon is Pamachic, once a large and important town; now there is nothing left but a small church, with bells cast in the eighteenth century. Napinori is but a few miles southwest. Farther southwest is Guagueyvo, a promising silver-mining region.

There are but few crossings; the upper one is known as Basiborachic, where the Batopilas Mining Co. maintains a suspension bridge. A little below the Barranca del Cobre is another suspension bridge. Here the canyon is a little over 3,000 ft. deep and for three months of the year the sun cannot be seen from the river. About fifteen miles farther down, the mouth of the Cusarare Creek comes in, and here is a crossing between Pamachic and Creel. About ten miles farther down is the turn in the general course of the river, and there is a large flow of trachite (non-mineral). Both below and above this is the common porphyry and chances for ore. The next crossing is at Topochichic de Abajo, from Pamachic to the mesa on the west side. Near this trail on both sides not far from the river are old mine workings. At San Andres del Rio and Uruquillo are crossings; both are abandoned mining regions. In three or four months of the year the river cannot be forded.

The Kansas City, Mexico & Orient railroad survey reaches the canyon brink at what is variously called Divisidero, Vista de la Barranca and Mesa de la Barranca. This place is opposite Pamachic, which cannot be over five miles away. Here the canyon is 3,700 ft. deep.



The canyon, from Divisidero, where the water flows west to the Rio Otero

The Nature of the Silver Veins at Cobalt

By J. E. Spurr

IN MY BOOK on Ore Magmas I showed a photograph¹ of one of the pre-Cambrian veins at Cobalt, Ont., which had been published in an article by W. L. Whitehead.² I showed this photograph as an argument that the veins were really intrusive veindikes rather than replacement veins, as had been believed by Dr. Whitehead and others; and the reason I pointed out for my belief was the exhibited occurrence of angular fragments of wall rock suspended and isolated in the vein. During the recent brief visit of the A. I. M. E. to Cobalt, I and others had an unusual opportunity for examining typical rich veins in the Nipissing mine which were being stoped. The general information we were given at Cobalt was that this might be nearly the last opportunity to examine such high-grade veins, which had made Cobalt famous, for in other mines they have been mainly exhausted. My inspection of these veins indicated that they were clearly intrusive veindikes, with perhaps some replacement of the wall rock on both sides of the veindike fissures; and it is therefore well worth while to put these notes on record, with some supporting photographs and sketches of specimens from the veins which were taken hurriedly and with but small opportunity for nice selection.

The veins I saw in the Nipissing mine have all the characteristics of true intrusive veindikes—they are branching and reuniting injections, inclosing isolated sharp angular fragments, and also long slabs, of country rock. Successive substages or episodes of vein injection are shown, as in one specimen, which shows an earlier injection of a smaltite (with much fine dissemi-

nated niccolite) veindike, which was split along one wall, and a later injection of niccolite and calcite forced up. The occurrence of niccolite in both injections shows that these injections followed one another closely in point of time and constitute a phenomenon of fractional splitting, or magmation, of the ore magma, which elsewhere in Cobalt frequently crystallized as a single veindike combining both these episodes; and that therefore these examples are hardly to be regarded as true compound veins³ any more than are the veins at Porcupine⁴ or at Kirkland Lake.⁵ The Cobalt veins are in the large sense one-stage veins exhibiting the usual differential crystallization, whereby some elements overlap and partially succeed others, where the crystallization was slow enough to allow this differentiation or magmation. Another instance of sequence of vein crystallization, which I observed in a specimen at the exhibit of Cobalt ores at the Nipissing mill, showed, on the walls of a little veindike, a first deposition of quartz, with a center of arsenides (smaltite, etc.), and native silver (Fig. 1). There was no second splitting here; the phenomenon, as I view it, was that of sequence of crystallization from an ore magma filling and distending a fissure which it had intruded—cooling with sufficient slowness to permit, in this unusual case, a graded crystallization, as shown.

Figs. 2, 3 and 4 are photographs of angular fragments in the Nipissing veins. There has been, clearly, no replacement of these sharp included fragments, as there has been of the included fragments of wall rock

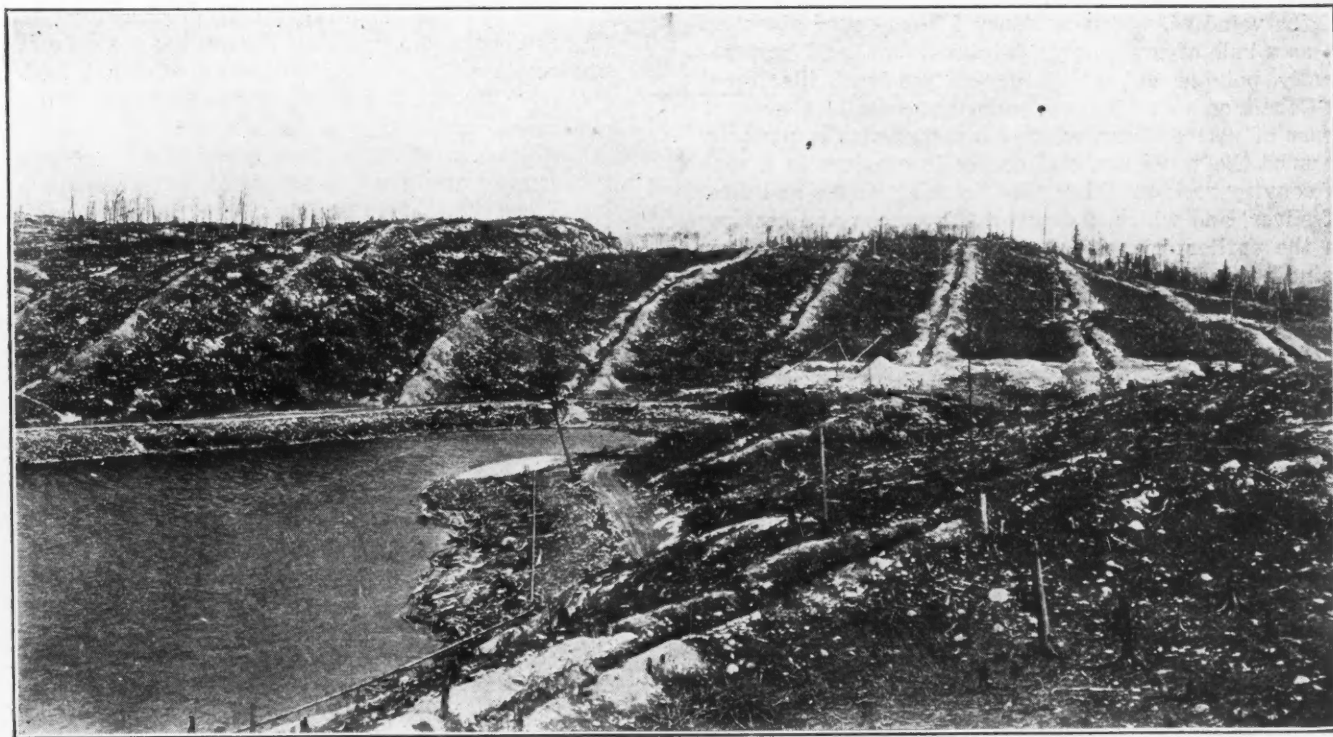
¹The Ore Magmas, Vol. I, p. 134.

²Economic Geology, Vol. XV, No. 2, p. 116.

³The Ore Magmas, Vol. I, p. 307.

⁴Eng. and Min. Journ.-Press, Vol. 116, No. 15, p. 633.

⁵Eng. and Min. Journ.-Press, Vol. 116, No. 16, p. 671.



Surface trenching in the Cobalt district

in the Porcupine gold-quartz veindikes;⁶ the ore magma must have been low in volatile (gaseous, including water-gaseous) constituents. This coincides well with my conclusions as to the relatively slightly aqueous content of basic-magma-derived ore magmas as compared with that of the siliceous-magma-derived ore magmas;⁷ for the Cobalt ores, as is well known and has been many times pointed out, are a phase of the basic intrusions of the Keweenaw period, and the igneous rock most closely associated and next of kin is the diabase intrusive (sill) at Cobalt; while the Porcupine ores are a phase of the siliceous intrusives of the earlier Algonian period, and the rocks next of kin are the siliceous-alkaline porphyries of that age.

The tendency of metals, in congealing ore magmas, to

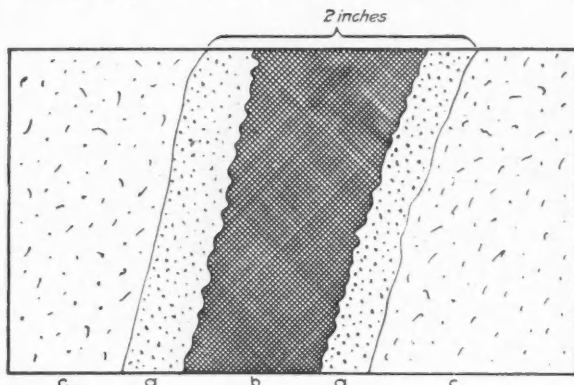


Fig. 1.—Sketch of specimen of Cobalt ores, showing successive deposition in little veindike. *a* = quartz, first deposition on walls of filled fissure. *b* = solid smaltite and other metallic minerals, and native silver, filling center. *c* = wall rock.

crystallize later than the bulk of the gangue minerals, and also to segregate toward the walls (under gaseous-tension pressure) or even to escape from the veindike, into the walls, or upward into a just-crystallized portion of the veindike, which tendency I have called attention to as a rule of ore magma crystallization⁸ and have recently pointed out at Porcupine,⁹ is well illustrated at Cobalt, on a striking and important scale, by the occurrence of native silver, which characteristically partially escaped the veindikes, and occurs in crevices in a zone of country rock on either side, forming sheets and films of silver, and which, moreover, fills cracks and crevices in the earlier crystallized calcite-arsenide-native silver veindike, just as at Porcupine native gold does in the earlier crystallized quartz (gold) veindike.¹⁰ This silver-impregnated country rock, extending often several feet away from the veindikes (which themselves carry far more silver and constitute the phenomenally rich ore) makes up the considerable tonnage of low-grade or milling ore of the district. In the veindikes themselves this late crystallization and high degree of mobility of the native silver has procured an irregular concentration of silver; so that while some of the veins seen were reported to carry locally several thousand ounces of silver to the ton, similar veins, and indeed other portions of the same vein, carry very little silver, while representing the same veindike intrusion—as shown by the presence of all the rest of the minerals of the characteristic veindike fabric, such as calcite,

smaltite, and niccolite. The explanation for the high migrativeness¹¹ and concentration of native silver above given, involves, of course, an upward as well as outward pressure in the veindikes: and accordingly, the tops of veindikes (for some of the veindikes have been found to terminate upward in the mines, constituting so-called “blind” veins) are said to be ordinarily relatively high in silver.

There is, it will be seen, no question in my mind that the silver is a primary ore-magma mineral: not the result of alteration and concentration by surface waters, whose effect at Cobalt has been negligible. In Cobalt, indeed, there is practically no zone of oxidation and rearrangement by surface waters, the pre-glacial zone having been gouged away by the glacier, and subsequent (post-glacial) time proving to have been inadequate for much superficial decomposition. Our knowledge of this type of ore deposit is recent, and when the rich native silver ores were discovered and were later found to fail characteristically at a certain depth, geologists with knowledge of the formation of native silver ores in the western United States, by reduction from sulphide ores under the influence of descending waters, were naturally inclined, by analogy, to regard the Cobalt ores as also secondary. But events and a better conception of the geology have proven that the analogy was a false one, and that the native silver ore here is primary and truly magmatic. The danger that lies in the “little knowledge” eternally threatens the geologist as well as the layman. Native silver veins have been found as deep as 700 ft. below the surface at Cobalt, though the values usually quit higher up.

The great influence of wall rocks in determining the locus of precipitation of the net final fraction of the ore magma is as striking at Cobalt as at Porcupine, or even more so. At Porcupine, it will be recalled, a gold-quartz veindike (for example, in the McIntyre mine) which runs from the (basic) Keewatin schists into the (siliceous) porphyry, is apt to lose most of its gold values, though the veindike itself may proceed bravely on. And at Cobalt 80 per cent of the ore has come from the conglomerates and other sediments of the Cobalt series, into which series the diabase has intruded. Most of these exposed sediments, at Cobalt, underlie the diabase sill, which has been partly stripped off by erosion; and veins pass down from the conglomerates into underlying Keewatin (basic) schists, representing ancient lava flows essentially like those of corresponding age of Porcupine. Many of the veins lose much or practically all of their silver values when traced (downward) from the conglomerates into the Keewatin, while the vein itself (of smaltite, niccolite, calcite, etc.) sometimes proceeds on in full width. The controlling influence of the wall rock on the precipitation of the final (silver) fraction of the ore magma is clear; and the explanation of this striking phenomenon is as nice a problem as in Porcupine—or still more exacting.

Considering first, the chemical influence of wall rocks on silver deposition, I have pointed out¹² that the basic-derived ore magmas, being calcic, would be most influenced to precipitation by siliceous wall rocks, just as the siliceous-magma-derived ore magmas, being themselves siliceous, are best influenced to precipitation by basic wall rocks. This would appear to be upheld at Cobalt, where the conglomerate and other sediments of

⁶Eng. and Min. Journ.-Press, Vol. 116, No. 15, p. 634, Fig. 2.

⁷The Ore Magmas, Vol. II, p. 620.

⁸The Ore Magmas, Vol. II, p. 524.

⁹Eng. and Min. Journ.-Press, Vol. 116, No. 15, p. 636.

¹⁰Eng. and Min. Journ.-Press, Vol. 116, No. 15, p. 636, Fig. 6.

¹¹A hint as to what helped the high mobility of the silver is found in the presence, in the silver, of a little antimony and mercury. (See The Ore Magmas, Vol. II, p. 617.)

¹²The Ore Magmas, Vol. II, p. 654.



Fig. 2—Photograph of vein from Nipissing mine, showing isolated angular inclusions of wall rock. Width of vein (calcite, niccolite, smaltite, etc.) about 4 inches. Note that fragments are variously oriented.

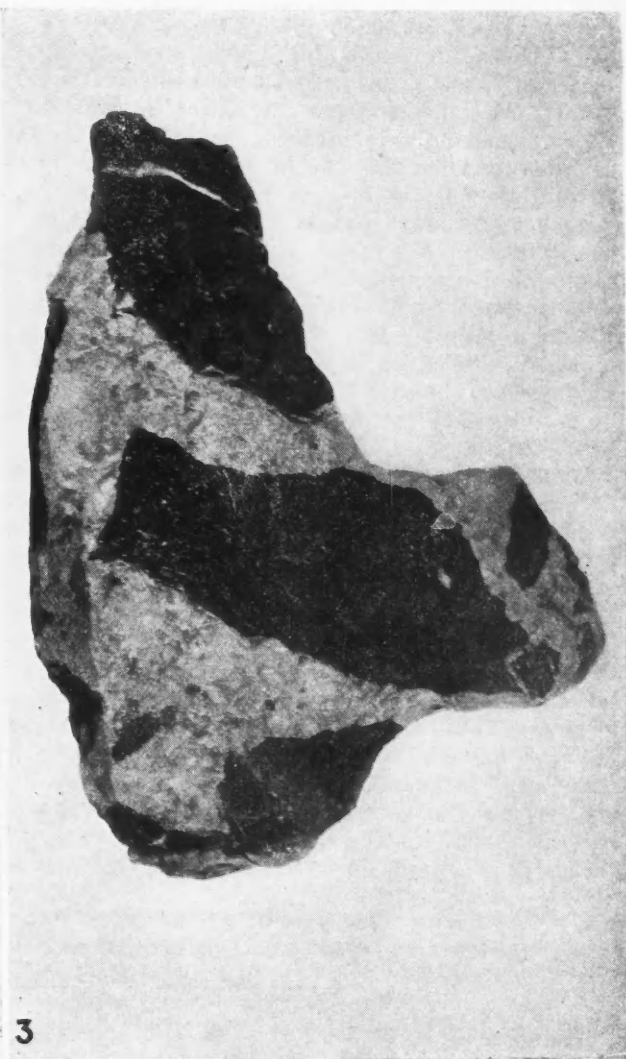


Fig. 3—Fragment of vein in Nipissing mine, showing angular inclusions of wall rock in vein calcite. Note sharp outlines and corners of inclusions, excluding the idea that they are residua of replacement. Length of longest fragment shown, 3½ inches.



Fig. 4—Vein from Nipissing mine, showing isolated and unsupported inclusions of wall rock. In this case the fragments have a general orientation parallel to the walls, which is the more usual situation. Both this vein and the small branching vein shown contain principally niccolite, smaltite, calcite, and silver, with other minerals. The larger vein has a width of 2 inches.

the Cobalt series, containing a large amount of granitic material,¹³ should precipitate from calcic solutions more readily than should either the Keewatin schists or the Keweenawan diabase, both basic rocks. Dr. Miller says¹⁴:

"Judging from the way in which silver is found in the minutest cracks in granite boulders of some of the conglomerate near the veins, this ore, at least, was precipitated no less readily in acidic rocks than in basic ones. With the exception of these boulders, there are few opportunities afforded of observing the relations of the ore to granite. But in the Temiskaming mine, a few hundred feet below the surface, narrow dikes of Lorraine granite intrude the Keewatin and are cut across by a vein. The surface of the granite is plated with native silver."

While this theory, as I have set it forth above, seems adequate to explain the influence of wall rocks on silver deposition at Cobalt, even more fully than the same theory does at Porcupine,¹⁵ I am still inclined to suspect, as at Porcupine, a physical reason also. At Porcupine I have found reason to suspect that relatively penetrable wall rocks induced not only replacement of walls by gold magma-solution, but a correspondingly precipitation in the veindike itself, by relief of gaseous-tension pressure due to expansion into the wall rock; and that for this physical reason relatively impenetrable wall rocks were unfavorable, not only for replacement ore, but for the best values in the intrusive veindike also. And at the Dome mine I mentioned how where the choice lay between Keewatin and Temiskaming sedi-

ments (conglomerate), 80 to 90 per cent of the ore was deposited in the sedimentary rocks. Now, here at Cobalt, where the choice is between Keewatin (and diabase), and the Cobalt series of sediments (resembling in a general way the Temiskaming), 80 per cent of the ore, or more, again chooses the sediments. Since the two types of ore magmas, in my opinion, differed greatly chemically, one being siliceous and one calcic, the choice of the conglomerates over the Keewatin schists seems to me to indicate a physical reason, probably collaborating with the chemical reason which I have submitted above; and that physical property I should call penetrability. Accordingly, where the ore magma (at Cobalt) penetrated (upward) along fissures in the Keewatin, and entered the Cobalt conglomerates, the gaseous tension of the magma was able to overcome the resistance of the conglomerate wall rocks, and to penetrate them; and, by the consequent relief of pressure, silver was at once deposited not only in the wall rocks but to a greater extent in the veindike as well; and this process was doubtless accelerated by the favorable chemical composition of the wall rocks, as I have pointed out above, producing the unusually sharp governing influence of these wall rocks shown at Cobalt. The suggested pressure factor probably operated at a constant temperature, for the different formations, as it did at Porcupine; for while some of the veins (in both districts) are impoverished on passing *downward* into an unfavorable formation, others are correspondingly impoverished on passing *upward* into an unfavorable formation—such as those veins at Cobalt, which lie in the Keewatin below the diabase, but do not extend upward into the diabase.

¹³W. G. Miller, Guide Book, Ont. Dept. Mines, 1923, p. 69.

¹⁴*Op. cit.*, p. 96.

¹⁵*Eng. and Min. Journ.-Press*, Vol. 116, No. 15, p. 637-8.

Things to Keep in Mind in the Selection of Mine Timbers

BECAUSE timber suitable for use in mines is becoming increasingly scarcer in most mining districts, and at many places must be shipped in, and because of the labor cost involved and the further fact that most mine timber cannot be recovered, there is greater and greater need for exercising good judgment in utilizing timber to the best advantage, says Bulletin 215 just issued by the U. S. Bureau of Mines.

The most important principle of mine timbering is to timber in time—that is, immediately after excavation and before the rock inside the natural rock arch becomes broken and begins to settle. If this principle is followed it will save time, money, and many lives.

The kinds of timber used in mining operations are as varied as the localities in which the mines occur. In some districts in which there is a scarcity of good timber, such as in the Southwest, the prospector and small mine operator use the dwarf varieties usually found in these arid regions, such as mesquite, sage brush, juniper, cottonwood, and pinon.

Long-grained timbers such as pine, fir, spruce, oak, and chestnut are preferred, because they will crack and split when pressure comes on them, and thus give warning long before they break. Although timbers should be long-grained, strong, and elastic, they should not be too heavy. Oak and chestnut and other long-grained hardwoods are strong, but many hardwoods are heavy to handle. Short-grained woods are often unreliable as an indicator of dangerous pressure, because they may break without warning.

The bureau advises that the use of such flexible woods as hickory, eucalyptus, and willow be avoided, if possible, as they bend easily under pressure and do not offer, in proportion to their size, much resistance to the movement of the rock.

Those timbers of the Pacific Coast that are best adapted to mining uses are Douglas fir, California fir, Sitka and white spruce, and yellow pine, but western hemlock, cedar, and redwood, and also oak, maple, chestnut, and other hard woods, are used where most easily available. Sometimes the scorched timbers of burned-over districts are used. When the heart of the timber is sound these have proved acceptable; they are cheaper than unscorched timber and are practically as strong.

In Alaska many objections are advanced to the use of native spruce and native hemlock for mine timber. Some mining companies have preferred to ship in Douglas fir from Washington and Oregon instead of using the native woods.

A fundamental principle to be kept in mind is that mine timbering should afford adequate support at least expense. Enough timber should be used to insure safety to the workings and to the men, but as timbering is often one of the chief items of cost in mining, the excessive use of timber is an economic waste.

Timbering serves primarily, by the prevention of caving and spalling, to keep the workings open for such time as is necessary for extracting the ore, or for purposes of transportation and ventilation. When the workings are abandoned, the timber therein has fulfilled its purpose and is so much waste material, although some of it may perhaps be recovered for reuse in other parts of the mine.

An Analytical Method of Summarizing Mining Reports

Use of a "Critical Value" of Ore a Factor Significant in Condensing and Presenting the Results of an Engineer's Examination of a Mine

By Frederick C. Fearing

Mining Engineer, Philadelphia

IN PRESENTING this somewhat "Volsteadian" subject to readers of the *Journal-Press*, it is to be hoped that discussion may be stimulated and constructive criticism obtained. It may be merely unfortunate coincidence, and again it may be a true reflection of a general condition, but the fact is that mining reports appear on the desk accompanied entirely too often by a pencilled note to "Please tell us what this report means—there is no adequate summary and we don't know whether we would be sufficiently interested to wade all through it until we see a short analysis."

At the outset, let it be remembered that the specific case to be described later happens to apply to a silver ore carrying a little gold, and that such a mine has many variables entering into its operating possibilities quite different from those of iron, copper, zinc, or other properties. Also, mines containing large bodies of low-grade ore of fairly even tenor have different variables from mines of the same metals whose ores are higher grade, shooty, and more or less erratic. In any case, no matter with what kind of mine we are dealing, it is axiomatic that any estimate worth the paper it is written on will take into account all factors involved. It is not within the province of this article to discuss the compilation of estimates, but rather to suggest certain broad principles in the use of such estimates and to illustrate them by specific examples.

THE BASIS OF THE ESTIMATES

Before launching into our main subject, however, it seems advisable to review one or two fundamental matters that seem frequently to have been lost sight of in attempts to estimate operating results. There are three courses open to us:

(a) To base all estimates on the cost of labor, supplies and power as of a certain definite date, taking the prices for the commercially recoverable metals as of approximately the same date. In such event the report itself should contain a careful analysis of the probable trend of production costs and of metal values for a considerable future period. It should not be understood by this that definite prophecies ought always to be made, but rather that the trends should be explained to the client, so that he may be fully informed.

(b) Study the statistics and trends of the factors entering into an estimate and arrive at the probable weighted average, projected into the future, so as to convey to the client the average results that might be expected for a considerable future period. At the same time, the assumptions underlying the estimate and its method of compilation and its limitations should be fully explained in the body of the report.

(c) If only the information given in (a) or (b) is made available to the client, he will have considerable

doubt as to the other. Wherever a complete report is required, and provided sufficient data are procurable to enable one to do so, estimates should be made both ways—that is, as of a definite date, in which case the figures should be extremely accurate; and for the future, in which the figures will be the "probable weighted average."

In many cases, however, it is not possible to set up any estimates of future results that can be demonstrated to be sound and reasonably conservative. A given mine may show attractive estimated earnings as of the date of examination, but the careful engineer may have good reason to feel that future operating results would not make the investment an attractive risk for his client. On the other hand, the mine may be examined at the worst possible time with respect to earnings, and the careful engineer will then point out to his client any sound reasons that may exist for viewing the proposition as capable of showing attractive future returns. In any event, the reports of engineers which indicate "between the lines" farsightedness, and a sincere attempt to advise the client whether or not the property constitutes a good business risk, are the sort of reports for which capitalists pay large fees, because they know that such reports entail an unbelievable amount of time and hard work. Someone once said that a genius is a person who takes infinite pains.

The case which we have chosen as an illustration, happens, as said before, to be that of a silver mine, and in accordance with (a) above, the estimated costs given are based on labor and supplies that ruled during the examination period. Prices for silver and gold had averaged \$0.60 and \$20 per ounce respectively for a long time previously. Obviously, the figures were compiled at a pre-war date. Future financial probabilities were also discussed in the body of the report at considerable length, and summary estimates were tabulated, giving the weighted average for several years ahead. Thus it is seen that both "present" and "future" results were treated independently, in accordance with (c) above.

The main portion of this dissertation consists of a deduction of the critical value C_v per ton of original ore, and this per ton unit would be used for all sorts of mines, though theoretically it might be changed to cubic yards in the case of placers. The critical value, to be of use to the mine superintendent, should be based on the customary quantity unit for measuring ore in place, whatever that unit may be. Such critical values naturally change from time to time with fluctuations in costs of labor and supplies, and with changes in the terms of smelter contracts. If, however, we have an equation for C_v in terms of the existing smelter contract and the other marketing costs, all of which

where total income just balances total outgo per ton—is also shown as the “Critical Value” per ton of ore, and will be denoted hereinafter by C_v . The graph gives the indicated profits as of date of examination, at the existing average value of all ore then available for economic extraction, for each rate of output. Where advisable, a secondary graph may show on the same chart “possible estimated future average results.” As already stated, however, I will not discuss the latter in this paper. Below the charts is a condensed tabulation giving all essential details, including the prices for the metals used in the computations, and a set of factors from which the average value of total available ore may be readily corrected to existing market quotations.

CHARTS SUPPLEMENTED BY NOTES

The second chart shows merely the total investment for each operating capacity. Below it is a condensed table showing how the total is made up, how much is funded, how much is stock, how much new capital is needed, and the sum to be amortized over the life of the mine. On these sets of charts “hang all the law and the profits,” leaving merely a few short, concise paragraphs for the written part of the letter of transmittal in which to set forth the geological, metallurgical, legal, construction, and operating findings, explaining the use and application of the charts, and, finally, a résumé of the recommendations. Two or three pages of typed sheets and the single sheet containing the charts are usually sufficient to present a complete, vivid, and flexible summary of any but a most complicated situation.

A case will now be worked out, the figures given being lifted from an existing report but simplified and modified where advisable for the purposes of this discussion. The word “capacity” as used herein is to be understood to mean the tons of ore mined per twenty-four hours. It is often advisable to study the effect on C_v , and on profits, of increased capacity, and the entire set of estimates were therefore compiled on the basis of the initial rate of 100 tons per day as well as for 250, 500, and 1,000 tons.

General. We will start out to find the critical value, C_v , and then the profit, P . Before we can find C_v accurately it is essential to have the data properly assembled, and to estimate the “life” of ore available for profitable mining. To do this we must make a preliminary guess of C_v . This preliminary work is explained in the paragraphs that follow, up to 2b. Paragraphs 2b and 2c deal with the calculation of the true critical value. The calculation of estimated profits comes next, in 3a and 3b. Subsequent paragraphs are devoted to a short description of how the results are summarized and tabulated for final presentation.

Step 1a. Estimates of operating costs are run out in the usual manner, but the tabulation is temporarily as follows:

Capacity (tons per day).....	100	250	500	1,000
Estimated tons per annum.....	31,000	77,500	160,000	330,000
Mining, including development and exploration.....	\$2.68	\$1.85	\$1.82	\$1.40
Concentrating.....	2.53	1.87	1.65	1.38
Hauling to railway and car loading.....	.99	.81	.43	.36
Superintendence and management.....	.67	.36	.22	.15
Taxes—all except income tax.....	.16	.09	.06	.04
Interest on funded debt (see Step 1b.).....	.48	.23	.13	.09
Total, excluding marketing, milling losses, amortization and income tax.....	\$7.51	\$5.24	\$4.31	\$3.42

Step 1b. Estimates of financial requirements for construction, equipment, working, and any other capital requirements are then compiled in the usual way for

each capacity. To these are added any unamortized sums previously expended in connection with the property, so as to obtain the total capital to be redeemed within the remaining life of the mine. Often these figures have to be resolved into outstanding bonds and capital stock. In the case under consideration the amount of capital stock and bonds to be retired under the terms of the financial plan was tabulated on a work sheet as follows:

Capacity (tons per day).....	100	250	500	1,000
Estimated tons per annum.....	31,000	77,500	160,000	330,000
Bonds outstanding (6 per cent).....	\$250,000	\$300,000	\$350,000	\$500,000
Stock outstanding (par value).....	550,000	600,000	1,050,000	1,500,000
Total value to be amortized....	\$800,000	\$900,000	\$1,400,000	\$2,000,000

It will be noted that nothing has been said thus far in regard to the probable life under the several capacities, based, of course, on “ore in sight” and embodying ore that can be measured to some extent, either wholly “blocked out” or “indicated” on two to three sides. It is to be understood that “possible” ore is not allowed to enter into any calculation of “probable” life. Here is where we often find that it is not possible to obtain sufficient data with which to proceed. There may be insufficient development, or the ore may be too erratic, or the market too restricted and variable, to make it wise to go on with our calculations for formal presentation. Sound judgment must be exercised, and whatever is done should be attempted only if entirely justified by sufficient data of the right quality.

Before going further into this matter of amortization it is first necessary to obtain an approximation of the point where profits would begin—that is, to approximate roughly the critical value, so that we can study this with respect to availability of ore. To do this we can roughly approximate the marketing costs as of date of examination and allow for mill losses (89 per cent being the average over-all recovery in this case) and add these to the totals for Step 1a. Our work sheet would then be:

Capacity (tons per day).....	100	250	500	1,000
Estimated tons per annum.....	31,000	77,500	160,000	330,000
Total of Step 1a.....	\$7.51	\$5.24	\$4.31	\$3.42
Add marketing, say.....	3.50	2.00	1.90	1.75
Subtotal.....	\$11.01	\$7.24	\$6.21	\$5.17
After dividing by 89 per cent (by slide rule).....	12.35	8.13	6.86	5.81

It stands to reason that these figures are less than the critical value by the amount of the amortization, yet to be computed. They are for trial purposes only, and are for use in the next step. From an inspection of the tonnage and assay sheets we can get a rough approximation of the ore that might prove available in the final calculations, and from this, as a basis, amortization can be calculated, and added.

Reinvestment of sinking fund at 4.5 per cent has been the custom when figuring amortization. In these approximations it has always been found to save time to try to make the figures fairly high rather than too low. Without going into further detail on this matter, it may be said that to the above subtotals we will add for amortization, say \$2.10, \$1.90, \$1.50, and \$1.25, which sums, after again dividing by 89 per cent, give new totals of \$14.74, \$10.27, \$8.66 and \$7.21 for tentative critical production costs (equivalent to C_v) at the respective capacities. With these to guide us, we next make a study of the ore available, as follows:

Step 1c. A recapitulation is made of all the ore blocks, “blocked out” and “indicated,” the tabulation being according to grade of each block, as of date of examination. Without going too deeply into so simple

a matter, it may be said that the summary is as follows:

Total "Blocked Out" and "Indicated" Ore Available

Daily Capacity	Ore of Grade Above:	Tonnage	Average Grade	Approximate Life, Years
100	\$14.74	279,000	\$17.20	9
250	10.27	542,700	12.20	7
500	8.66	961,200	10.10	6
1,000	7.21	1,853,300	8.45	5

The sinking-fund requirements, calculated on the above basis of "life" and for the redemption of the capital shown in Step 1b, are found from sinking-fund tables and divided by the estimated outputs per annum. The amounts per ton are \$2.39, \$1.45, \$1.30, and \$1.11 respectively.

If the inspection and choice of arbitrary "trial" figures for marketing costs have been somewhere near the mark, the per-ton amortization charges just obtained may prove accurate all the way through the rest of this discussion. If they should not, it would be necessary to go back and recalculate a great deal of the work—which process is to be avoided. However, Step 1 is now almost completed, but there is one subdivision left:

Step 1d. It will be noted that all the items of operating expense listed under Step 1a depend on the output. So does amortization. But marketing depends on the grade of the ores. It generally costs more to market high-grade ore per ton of ore mined than it does to market ore of low grade, and the tonnage has nothing to do with the unit cost of such marketing. On these two observations the future deductions must be based—and divided into two general parts, of which the first is about to be closed.

Amortization remains to be included in the total of Step 1a. In doing this, all marketing costs and deductions are purposely left out of the tabulation, nor is attention paid to mill losses, because these too are actually a part of "marketing," being incurred in the interest thereof. Furthermore, the higher grade the ore milled, the greater will be the money loss per ton, even though the percentage milling loss may be nearly constant. Therefore, mill losses belong under the head of items that depend on grade of ore—namely, under "marketing." Nor are income taxes yet to be considered, because at present only the calculation of C_v is in order, which provides nothing in the way of income to tax. Therefore the items of Step 1a are tabulated on the basis just explained, using the sinking fund charges calculated in Step 1c. This results as follows:

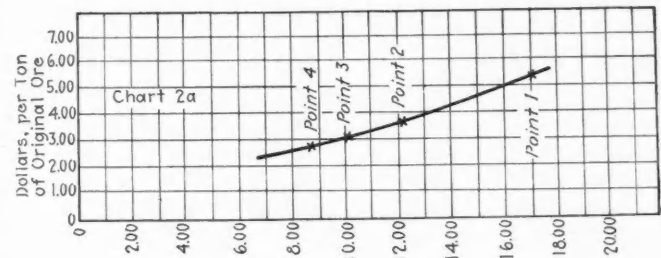
Capacity (tons per day)	100	250	500	1,000
Estimated tons per annum	31,000	77,500	160,000	330,000
Mining, exploration and development	\$2.68	\$1.85	\$1.82	\$1.40
Concentrating	2.53	1.87	1.65	1.38
Hauling to railway	.99	.81	.43	.36
Superintendence and management	.67	.36	.22	.15
Taxes (except income)	.16	.09	.06	.04
Interest on funded debt	.48	.23	.13	.09
Amortization (Step 1c)	2.39	1.45	1.30	1.11
Total = cost f.o.b. railroad	\$9.90	\$6.69	\$5.61	\$4.53

These totals will hereinafter be referred to by the letter *R*.

Step 2a. We have yet to consider, as a separate matter, the cost of marketing, and, for reasons that will become apparent later, it is necessary to find the equation which represents this cost in terms of the value of the original ore. Let *M* stand for the cost of marketing and let *V* be the value of the original ore. In attacking the problem the first obvious thing to do is to find the "habit" of the ore for different grades, and in searching for these data it is scarcely necessary to go farther than the grades given in Step 1c.

From the original tonnage and assay data it is easy to ascertain the average analysis of the total ore comprising the tonnages that run \$17.20, \$12.20, \$10.10, and \$8.45 given in the step just mentioned. From this it is equally easy, from the mill data, to calculate the concentration results. From the tonnage and grade of concentrates we can calculate, using prices of the metals as of date of examination, what the mill loss in metals amounts to in terms of dollars, per ton of original ore. Similarly we can calculate the railway, insurance, smelting, refinery charges and deductions of all sorts and finally arrive at the total of all these items, per ton of original ore. In the case in point the material was a highly oxidized silver ore, carrying a little gold, and quite high in recoverable iron. The results, made up as just described, are as follows:

Point No.	1	2	3	4
Mill losses (value of ore lost)	\$1.89	\$1.34	\$1.11	\$0.93
Shipping, smelter and other charges	3.52	2.48	2.13	1.89
Total, = <i>M</i> = "marketing"	\$5.41	\$3.82	\$3.24	\$2.82
<i>V</i> = corresponding ore value, in place	17.20	12.20	10.10	8.45



Value of ore in place—Ordinates *M*, Abscissae *V*

After plotting, it appears that the curve is probably a parabola, symmetrical to the vertical axis, *M*. This proves later on to be the case and therefore its general is equation expressed by

$$(A) \quad M = A(V)^2 + B(V) + C$$

Substituting the values of *M* and *V* obtained from, say, points 1, 2, and 4—point 3 being left until later to check with—we get three simultaneous equations, which we will number according to the points used:

- (1) $5.41 = 295.84 (A) + 17.2 (B) + (C)$
- (2) $3.82 = 148.84 (A) + 12.2 (B) + (C)$
- (4) $2.82 = 71.40 (A) + 8.45 (B) + (C)$

whence $(A) = 0.00588$; $(B) = 0.145$; $(C) = 1.175$. Substituting back into *A* we get

$$(B) \quad M = 0.00588 V^2 + 0.145 V + 1.175$$

which is the equation of the cost of marketing, under the existing smelter contracts, including mill losses, in terms of the original value of the ore in place. If this deduction has been made correctly, the substitution of \$10.10 for *V* should give \$3.24 as the value of *M*, these being the co-ordinates of point 3. We get \$3.2393, or \$3.24, thus proving the equation.

Step 2b. We are now ready to find the correct critical values, C_v . After we have done so we must then reinspect the tabulation of ore blocks (Step 1c) to make sure that no ore has been included in its compilation of grade lower than the true C_v . If such should prove to be the case, we would have to (a) revise the tabulation of Step 1c; (b) recalculate the dependent amortization costs per ton and then arrive at a revised total for *R*, under Step 1d; (c) then recalculate C_v . For the purposes of this discussion, we will assume that such revisions are not necessary. Their exposition would be mere repetition.

Step 2c. Our problem now resolves itself into the following proposition:

To find the sum for marketing, which when added to the cost f.o.b. railway R will yield a total cost that can just be met from the value of the ore. In other words, the value of the ore must equal the total cost f.o.b. railway R , plus the cost of marketing, M . This would mean neither profit nor loss, and the value would be the true C_v per ton of original ore. Let us put this in the form of an equation:

$$R + M = \text{total production cost} = \text{value of ore in place.}$$

In this case the value of V will be the critical value, or C_v , so we may write the relationship thus:

$$(C) \quad V = R + M = C_v$$

Substituting for M its value as deduced in equation B , in Step 2a, we have:

$$V = R + 0.00588 V^2 + 0.145 V + 1.175$$

Whence we get

$$(D) \quad V = C_v = -\sqrt{5086.04 - 170.07 R} + 72.704$$

in which the minus sign is to be used before the radical. This gives the equation of the critical value, C_v , in terms of the cost of production f.o.b. railway, R . From it we can find C_v for the various capacities studied merely by substituting the value of R and solving. The difference between R and C_v will be the marketing cost, M . Referring to Step 1d for the values of R , solving for C_v and tabulating:

Capacity.....	100	250	500	1,000
Critical values, C_v	\$14.39	\$9.87	\$8.42	\$7.01
Deduct R	9.90	6.69	5.61	4.53
Balance, marketing, M	\$4.49	\$3.18	\$2.81	\$2.48

Attention is here called to the remarks about revisions made in the opening paragraphs of Step 2b. A comparison of the calculated values of C_v with those temporarily arrived at, by approximations, in the last paragraph of Step 1b, will disclose discrepancies hardly large enough to be likely to cause a revision of tonnages available under the several capacities. Consequently, there need be no revision of "life," and its dependent amortization charges entering into R , and the values for C_v just calculated can stand.

NECESSITY FOR INTELLIGENT INTERPRETATION

Attention is also called to the fact that the values of R and M in equation (C) are changing all the time—especially R . However, in the case of any efficiently managed property, the general manager will know very closely what R amounts to, and he should also be able to adjust it quite accurately for any piece of ground that he may contemplate mining. The equation (B), for M , when once obtained is likely to remain in force for a much longer period and, therefore, equation (D) is the most useful and not subject to frequent changes, except for R .

Step 3a. The calculation of profits is now in order, involving adjustments due to imposition of "income" taxes or any other charges varying with the net income. We are going to end up with a graph, for each capacity, and this calls for the establishing of points on a curve, three being the necessary minimum. We already have one set of these—the critical values—where the profit, P , is zero. Two more are needed, and should be chosen for convenience on ore of greater value than \$14.39, the highest critical value we have. Let us use gross values for ore in place of \$15 and \$20. Substituting these in equation (B), and solving for M , we get:

For \$15 ore, $M = \$4.66$, including milling losses.

For \$20 ore, $M = \$6.43$, including milling losses.

If we add these to the values of R we get total production cost for these two different grades of ore, which, upon being subtracted from the gross value, gives net taxable profit. Several of the tabulations have contained the estimated annual output under the several capacities, from which, knowing the unit profit, we obtain the total taxable profit per annum.

HOW MISCELLANEOUS ITEMS ARE HANDLED

The corporation income tax (federal) is not levied until profits exceed \$2,000 per annum. The rate is 12.5 per cent on all net income above \$2,000. This percentage, if applied on this exempted amount, is only \$250 per annum, and in our case is equivalent to only eight mills per ton at the most—on the annual output of the 100-ton plant. If, therefore, we ignore the \$2,000 exemption and let the tax apply to profits from zero to \$2,000, our estimates of net surplus will be too small within this narrow range of profits by merely eight mills per ton at the outside. This is hardly worth considering, more especially as the discrepancy is on the side of conservatism.

Depletion allowance is considered to have been included under the general annual sinking-fund charges, and in this case needs no further consideration. Interest paid happens to have been taken care of under "Funded Debt." After figuring the taxable profit and the amount of income tax and deducting the latter, we obtain "net annual surplus, available for dividends" for use in connection with the final chart. Net annual surplus is then converted into the equivalent profit per ton P , for ores of the values chosen, giving rise to the following three points for each capacity—all as of date of examination:

Capacity	100		250		500		1,000	
	V	P	V	P	V	P	V	P
Point 1....	\$14.39	\$0.000	\$9.87	\$0.000	\$8.42	\$0.000	\$7.01	\$0.000
Point 2....	15.00	3.393	15.00	3.197	15.00	4.140	15.00	5.084
Point 3....	20.00	3.217	20.00	6.023	20.00	6.966	20.00	7.911

Step 3b. Upon making a preliminary plat of these points on a fairly large scale (as they are nearly straight lines) it will be discerned that the curves all bend to the right. That is, they are probably parabolas, symmetrical to the V axis. It has been found by experience to be highly advisable to deduce their equations, not only to assist in the final plating of the charts but for the engineer's own use.

The points obtained enable three simultaneous equations to be formed in A , B , and C from the general equation of the parabola symmetrical to the V -axis,

$$(E) \quad V = A(P)^2 + B(P) + C$$

and the equation in V and P is to be found therefrom precisely as in the deduction of equation B , in Step 2a. In this case we get (for the 100-ton capacity), for example:

$$(F) \quad V = 0.0678 (P)^2 + 1.525 (P) + 14.39$$

which is not a convenient form for use, and requires simplification by solving for P . We may therefore write:

$$0.0678 (P)^2 + 1.525 (P) = V - 14.39$$

and we get:

(G) Profit ore-value equation, for 100-ton capacity:

$$(P)_{100} = +\sqrt{14.749 (V) - 85.77 - 11.246}$$

(H) Similarly, for 250 tons

$$(P)_{250} = +\sqrt{35.63 (V) + 410.41 - 27.78}$$

(J) And for 500 tons

$$(P)_{500} = +\sqrt{38.76 (V) + 498.48 - 28.72}$$

(K) For 1,000 tons

$$(P)_{1,000} = +\sqrt{40.161 (V) + 560.392 - 29.061}$$

These, then, are the final equations, in which the profit per ton, available for dividends on capital stock,

is expressed in terms of the gross value per ton of the original ore, based on conditions existing at date of the examination.

Step 3c. We are now almost ready to make up the final summary sheet, as shown herewith, it being noted that all figures given are classed as estimates based on conditions as of a certain date. As such, the results will be reasonably accurate. When advisable to do so, the last four equations may be calculated on the basis of probable future average conditions, and the curves plotted on the same charts, using a distinctive kind of line, but this has not been done in this instance for reasons stated in our opening paragraphs. However, boards of directors frequently want to know, not only what the unit profits are likely to be, but, in addition thereto, what the equivalent earnings amount to per annum as a percentage on the capital stock. Knowing, as we do, the par value of shares outstanding, it is a matter of simple arithmetic to work out these results, because the probable profits can be easily computed from the respective equations.

Every important item that a busy executive would seek first of all, can be readily found on the summary sheet with the exception of the geological conclusions and general recommendations. These do not lend themselves to presentation thereon and should be included in one or two pages of the letter of transmittal, of which the summary sheet forms the main feature. Certainly, it should never be necessary to wade through a number of pages of text, maps, diagrams, and tabulations in order to glean what the engineer's opinion actually is. The large mining interests will not proceed with an

enterprise presented for financing on the basis of incomplete or hazy reports. It would no doubt be a revelation to some engineers to discover how many excellent opportunities are lost, to promoter and financier alike, through this cause.

In one important particular the summary differs from the customary one in that it shows *definitely* the line of demarkation between *ore* and *rock*. It brings out plainly the fact that what is *ore* at 1,000 tons daily output is nothing but common, "garden" *rock* at higher critical values of lesser capacities. This is one of the most important things to be determined in connection with any property—the point where recoveries will just balance outgo—where the property "carries itself," and should be deduced as closely as the existing development of the mine will permit. Tonnage of greater value can then be properly classed as *ore* and that of lesser value can be classed as *rock*.

If this paper stimulates useful discussion within and without the profession it will have accomplished at least a part of its purpose. It is not put forth as a hard and fast, nor as a perfect, method applicable to all cases, but the underlying principles, it is hoped, may prove useful.

It would be ungracious to fail to acknowledge before closing the many valuable suggestions and criticisms received in the course of preparation at the hands of William F. Kelly and Charles B. Cooke, Jr., consulting engineers of Philadelphia; from George Warren Tower, Jr., and J. Parke Channing, of New York, and from Prof. Alexander N. Winchell, of the Department of Geology, University of Wisconsin.

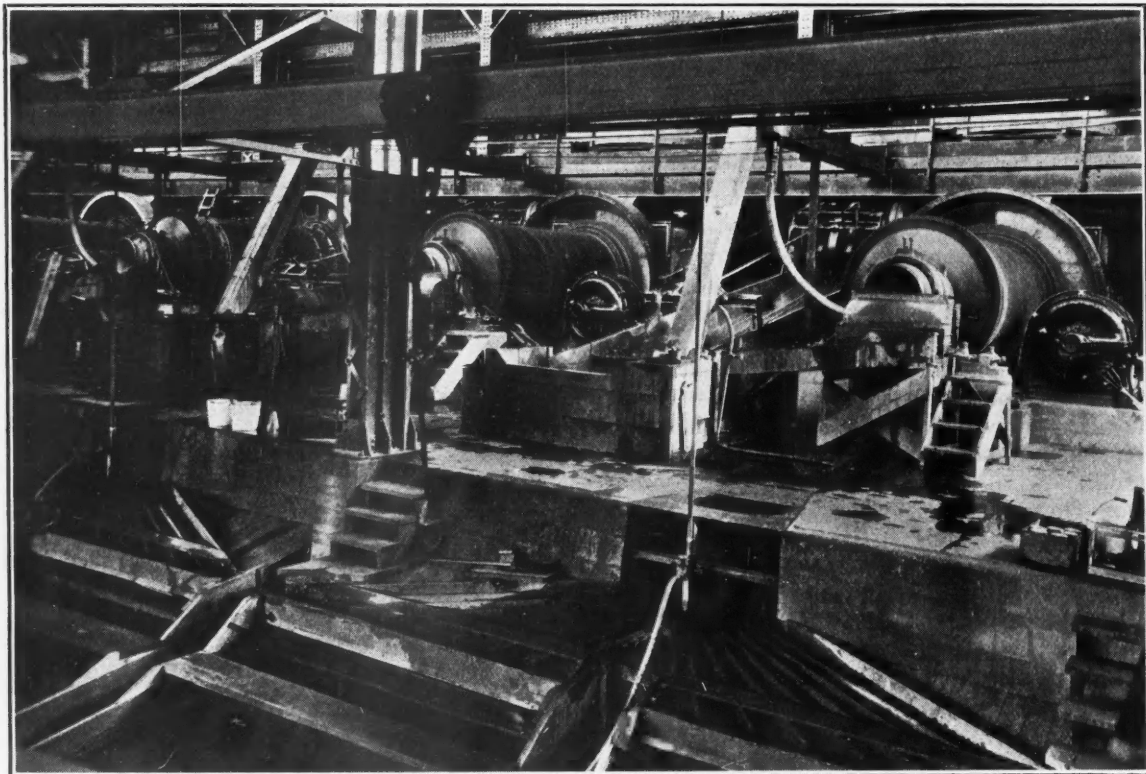


Photo by A. A. Lease

A few of the Allis-Chalmers rod mills in the South Mill of the Homestake Mining Co. at Lead, S. D.

Six of them, 5 ft. x 10 ft. 1½ in., operate in closed circuit with Dorr classifiers

Engineer Tells of Prospects in Yaqui Country

Explores Vast Area in Sonora, Mexico—Outcrops Everywhere—Natives Are Industrious and Hospitable

By John Leroy Drug
Mining Engineer



John Leroy Drug

AFTER carefully analyzing the results of two and one-half years of exploration in the Yaqui Indian country in Sonora, Mexico, I feel sure that the district will eventually develop into one of the important mining areas on the North American continent.

Kirby S. Yowell, an experienced mining man and prospector, who lives at Yuma, Ariz., after spending a month in the field with our engineers, said: "In one

month here in Sonora I've seen more outcrops and surface indications of ore than during my entire fourteen years of prospecting throughout the western part of the United States." This was no doubt an exaggeration; nevertheless it indicates the widespread mineralization of the area.

The central part of the Yaqui district has not been thoroughly prospected in the past, because of conditions caused by the various Yaqui uprisings. Here, there are many copper-stained outcrops and gold values are generally found in the copper-stained ores. These veins, if they could be transplanted on the northern side of the international boundary, would be snapped up in a hurry, but here there are scores of deposits that have never had a pick stuck into them. These conditions are due for a change, however. Mining activity in Sonora was beginning to reach the boom stage when the first revolution occurred in 1909. Up to that time Guaymas and Hermosillo were thriving cities and enjoyed prosperity principally from the mining industry. Then came the dark days of revolution and the raids of the Yaqui Indians, which gradually caused a shutdown of most of the mines with the exception of San Javier.

Fear of further trouble has prevented a return to normal in this state. Even as late as June, 1920, when my associates and myself were preparing to enter the field, we were repeatedly warned by the citizens of Guaymas and Hermosillo not to go out into the hills. We were taking our lives in our own hands, they warned us.

EXPERIENCED NO TROUBLE WITH INDIANS

But we were determined to investigate for ourselves, and found their fears unwarranted. From that date to this we have experienced no trouble whatever in the Yaqui district. We have encountered the Yaquis on various occasions and have always found them peaceable and agreeable.

In due time many prospectors doubtless will make

their way here. However, the man who is not acquainted with the country and with the natives and their methods has some grief in store.

A foreign prospector or mining man who makes his appearance in any of the inland towns is usually approached by several of the natives who have prospects to show. Before making the trip to investigate the property, however, the prospector is informed that it will be necessary for him to leave a few pesos for the family to exist on. The native also demands a rental for the mules which he provides and there are a dozen or more other revenue-gaining tricks where the native gets a "commission."

THE "WAYS" OF THE NATIVES ARE PECULIAR

Hundreds of these professional "prospect showers" make their living at this game. In some instances when a newcomer bargains with some of them to see their prospects he is paying for a chance to see various properties that have been examined and turned down by a score of other individuals.

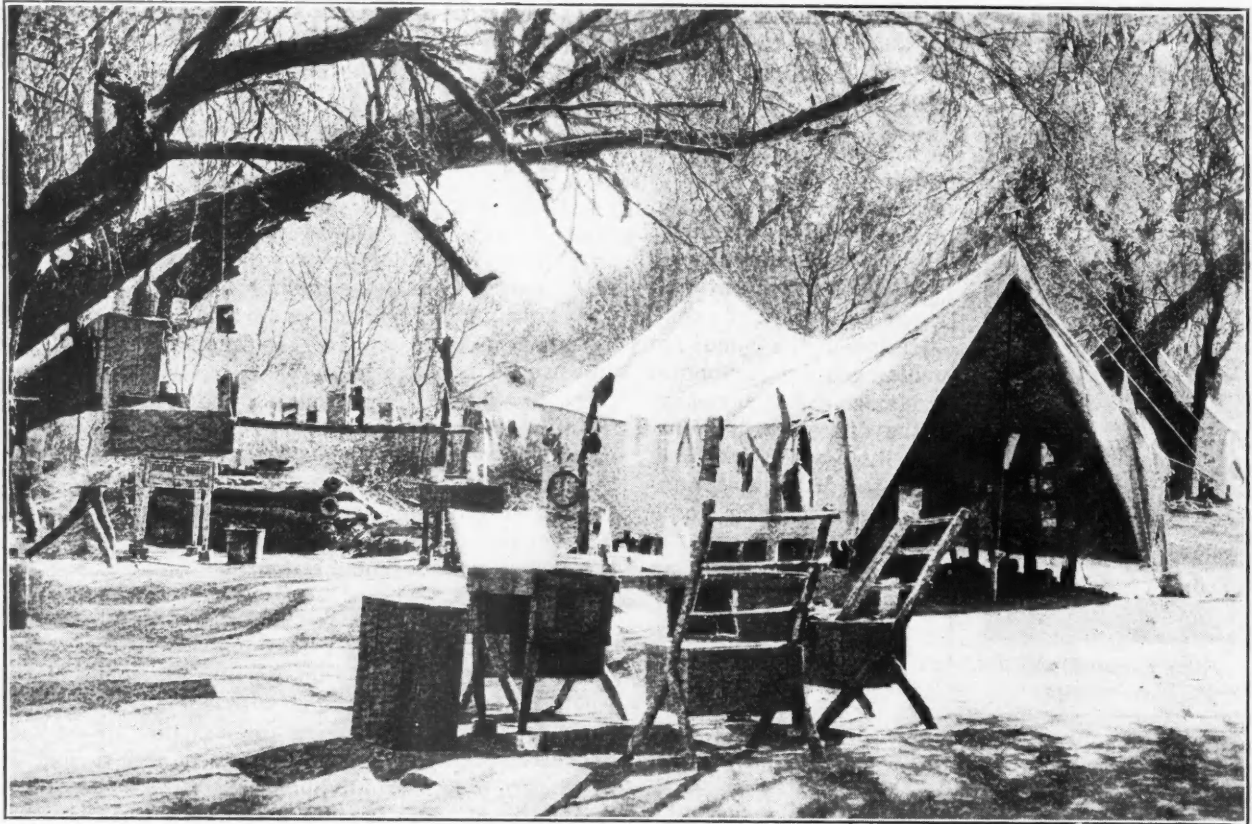
The situation is vexing, because of the fear that if one does not go out to look at a property he may be overlooking a good one. It is indeed difficult for the newcomer to distinguish between the reliable and the unreliable native miner.

Fortunately for my associates and myself we were forewarned about some of the difficulties which would confront us upon entering this district, and as a result I have worked out an exploration plan that has eliminated some of these annoying circumstances to a great extent.

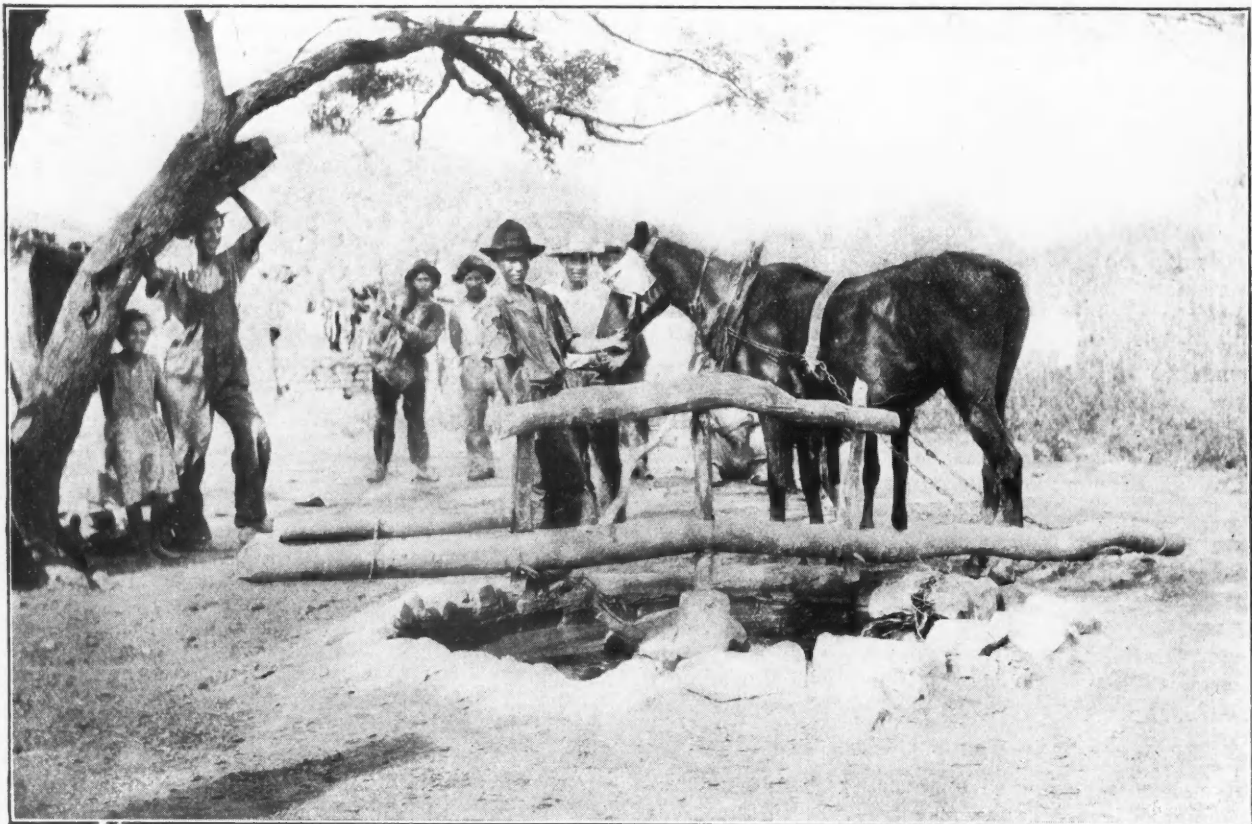
When I moved our field organization to Suaqui Grande, in June, 1922, I avoided any deals with the professional high-grader known in this country as the "gambusino." Instead, I engaged as a guide an old native who was recommended as thoroughly reliable and who had ridden this range for the last forty years. I found that old Manuel knew the location of nearly every old mine, prospect, and outcrop in this district, so I instructed him to show me everything he knew of regardless of whether it was a titled property, a prospect, or merely an outcropping. He did. The result was that with Manuel's knowledge of the district we looked at more than a hundred properties, which resulted in our acquiring four of our best holdings. At the same time we avoided the tricks of the professional prospect shower.

My associates and myself also launched another prospecting expedition from Soyopa, Sonora. The confidence of the natives is a very essential factor toward success in this country. So many of our own countrymen with exceptionally bad records have operated in western Mexico during the last twenty years, that the stranger is compelled to prove his reliability before he gains the confidence of the natives.

At least 80 per cent of the male population of any of the towns in the vicinity of the Yaqui River are more or less familiar with prospecting, mining, and



The modern prospector's "Home, Sweet Home"



The Arrastre—The only improvement in milling in 300 years is the substitution of the horse and mule for the burro. Several of these antiquated machines are in operation today at Bonancita



Native youths panning gold at Suaqui Grande—These little chaps get the "colors" if any are to be had



*Group of native miners at Bonancita, where several high-grade gold veins have been opened recently
Locally they are known as "gambusinos"*

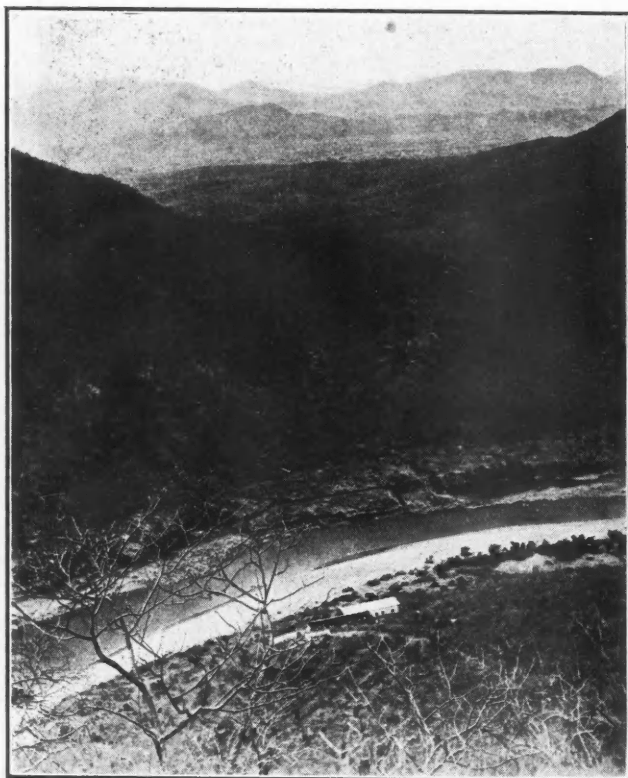
ore, because the majority of them have been compelled to exist by "high-grading" during the years of revolution.

WILL EMPLOY 100 PROSPECTORS

To take care of the assay work I have moved my metallurgical office to Soyopa, so that the organization will be able to make the necessary qualitative and quantitative determinations with promptness. I expect to have more than 100 native prospectors at work soon.

During the early part of our exploration of the Yaqui country we confined our efforts mainly to gold and silver, but since that time we have come across so many of the rarer minerals, metals and earths, that we have decided to devote much attention to the rarer elements in the future.

The native prospectors, in the past, have paid little attention to anything except gold, silver, copper, and



*Yaqui River from the San Miguel mine,
north of Soyopa*

lead. With the aid of a special cabinet of the rarer minerals and clays we are planning to give instruction to prospectors, so that they may become familiar with the general characteristics of the rarer ores that may be found in the region.

During the last two and one-half years the organization has acquired twelve properties, mostly gold, silver, and copper, but we have examined from time to time some interesting deposits of vanadium, molybdenum, tungsten, manganese, mica, asbestos, nickel, and cobalt. We have also examined several deposits of rare earths and other chemical elements that some day may become valuable.

RAILROAD CONSTRUCTION WILL BE BIG HELP

The Yaqui River branch of the Southern Pacific of Mexico is being reconstructed. Service on this line will be extended as far as Cumuripa before Jan. 1, 1924, it has been announced. According to the present schedule

the road will be completed as far as Tonichi in about eighteen months. Nothing will do more to bring about the revival of mining in this district than the rehabilitation of the Yaqui River railroad and the institution of regular traffic.

The central part of the Yaqui district is very flat and lends itself to auto transportation. In fact, that will be one of the outstanding features of mining in this part of the state—the fact that a great majority of these properties can be made easily accessible to auto transportation.

With the exception of June, July, and August, the rainy season in this part of the country, the climate of Sonora is delightful and greatly resembles that of Southern California. At that, one should not even complain of the rainy season here, as it is no worse than the summer season in the Mississippi Valley and other parts of the United States.

DUTY REMOVED ON MINING MACHINERY

In this district the labor conditions differ widely from those near the United States border in such places as Cananea, Nacozari, and in parts of Chihuahua, where the labor organizations have imposed certain hardships on the operators. Here they are more favorable. Workers in this district are unorganized and anxious to work. If given humane treatment, I find, the native workman and miner exhibit exceptional loyalty and give more than value received for their compensation.

The average wage here is 3 pesos per day, which is the equivalent to \$1.50 in U. S. currency. In the matter of mining supplies conditions vary somewhat. The government officials in Mexico City have removed the import tax on mining machinery in an effort to lessen the burden of the mining operator, but have overlooked some of the other supplies which are very essential to the mining industry. Take, for example, automobiles, trucks, and auto accessories. These are very necessary to the mining industry here, but the import duties are excessively high. There are many other minor articles necessary in mining that also are subjected to excessive import duties, but from their attitude shown on other matters I am of the opinion that the government officials will adjust these difficulties in the course of time.

AN EXCELLENT OPPORTUNITY FOR PROSPECTORS

Sonora, especially the Yaqui country, offers splendid opportunities to the mining fraternity, but it must go through the development period. One eminent mining man once opined that "mines are made and not found" and that seems to fit the situation here. The ore must be blocked out.

Many foreign prospectors have entered western Mexico in search of paying placers, but I believe that there is no such a thing as the poor man's placer in western Mexico today. We must not overlook the fact that the Spaniards were expert placer miners and that they were in here more than three centuries ago.

To those who have never had the pleasure of meeting the real Mexican people at home, I may say that there is an agreeable surprise in store for them. They are a most hospitable and affable folk.

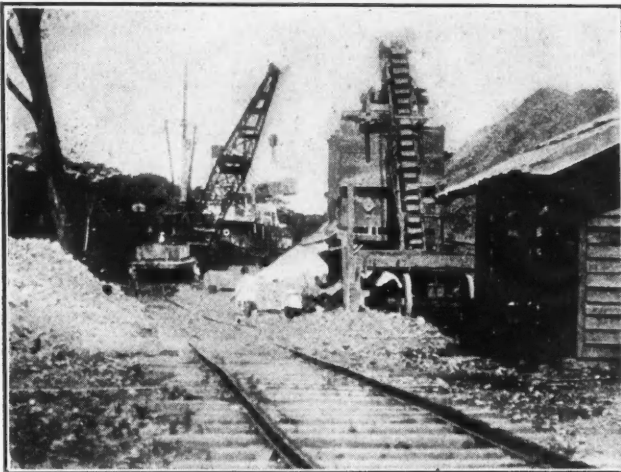
Mexico is stepping into a new era, especially as far as mining is concerned, and I have reason to believe that the lives and property rights of the foreigner, as well as of the native citizenry, will receive adequate protection in the future.

Bauxite Mining Resumed in Guiana

Subsidiary of Aluminum Company of America Ships Regularly From South American Mines

THERE are two bauxite mining districts in South America which will undoubtedly play an important rôle in the aluminum industry of the United States. One of these districts is in British Guiana, on the Demerara River, about 60 miles south of Georgetown. A plant and mines are being operated in this district by the Demerara Bauxite Co., Ltd. The other district is in Dutch Guiana. Some of the Dutch Guiana deposits are situated about 100 miles southeast of Paramaribo and are operated by the Surinaamsche Bauxite Maatschappij. Other deposits occur about 20 miles south of Paramaribo and are owned by various companies. Both the British and the Dutch Guiana districts, though far in the interior of the colonies, are situated on rivers navigable by ocean steamships, and ocean-going vessels of 16- to 17-ft. draft can be brought up-stream practically to within a stone's throw of many of the bauxite deposits.

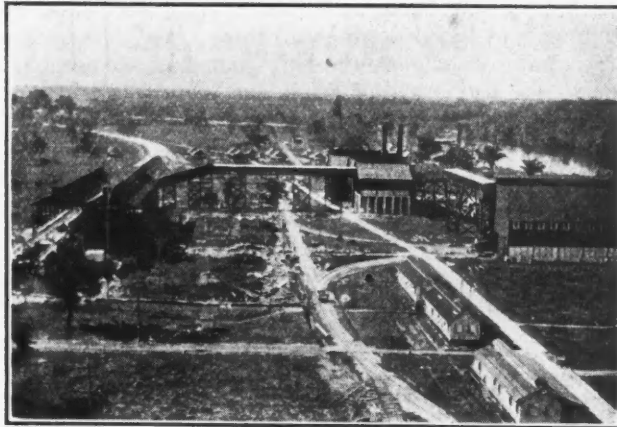
In the Demerara River district bauxite deposits cap the summits of a number of small hills stretching along



Loading crude bauxite by means of a crane

both sides of the river from Wismar and Mackenzie southward for about 10 miles. Wismar is an old trading point on the west bank of the river. It is connected with Georgetown by a tri-weekly launch service down the Demerara River, and a small railroad runs eastward from it to Rockstone, on the Essequibo River, which point is the base for communications with the interior of British Guiana by way of the Essequibo River.

Mackenzie is a new town built by the Demerara Bauxite Co., Ltd. In it are the bauxite-crushing and drying plants, power house, storage building, and other installations. There are also the living quarters of the employees and the villages for the native laborers. The ore-crushing and drying plant and storage buildings are situated on the river bank directly back of an 800-ft. modern dock, at which ocean-going vessels can be moored. They are loaded with bauxite by means of automatic conveying machinery. Up to the present time, only one bauxite deposit has been operated, this being the Three Friends mine, which is on the east bank of the Demerara River and is connected with the plant at Mackenzie by a 10-mile narrow-gauge railway. A chemical laboratory and quarters for the mine laborers are



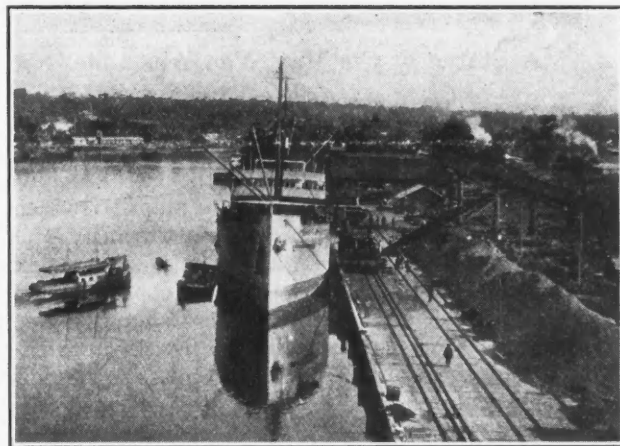
The plant of the Demerara Bauxite Co., subsidiary of the Aluminum Company of America, in British Guiana

situated directly across the river from the Three Friends mine, at Akyms.

Bauxite was first mined and shipped from the Three Friends mine in 1917. A number of shipments were made in 1918 and a few in 1919. During 1920 and the early months of 1921 a large tonnage of ore was shipped to the United States, but, because of the business depression, the mines and plant were closed down early in 1921 and were not reopened until recently. At present, however, shipments are moving northward at the rate of at least one cargo per week, most of the bauxite being consigned to Gulf ports, but occasional cargoes are coming to ports on the Atlantic seaboard.

The Dutch Guiana mining operations, which are conducted about 100 miles southeast of Paramaribo, are at a place known as Moengo, on the east bank of the Cottica River. The bauxite deposits of this section occur scattered over a large area, some of them being on or near navigable rivers and others some distance back from the rivers. The deposit at Moengo itself, which is the only one at present being operated, is situated directly on the river bank.

Preparations were made to install at Moengo crushing and drying machinery similar to that installed at Mackenzie. The business depression and the lack of demand for bauxite, however, interrupted the construction work, and the plant is at present in a half-finished condition. Employees' and laborers' villages, however, have been built and sanitation measures are in effect. A dock



A vessel on the Demerara River being loaded with bauxite

has been partly constructed along the river bank, and shipments of bauxite are being made from time to time. Since, however, the ore-treating plant has not been completed, shipments are of crude ore just as it comes out of the mine. The first shipment of Dutch Guiana bauxite was made early in 1922.

The bauxite deposits situated about 20 miles south of Paramaribo are on both banks of the Surinam River. No mining operations of importance have been started in this area.

It is stated that large supplies of bauxite are available

in the Guianas, and preparations are in progress for using increasingly large quantities of this material in the United States and Europe. The Aluminum Company of America, which is the largest consumer in this country of both domestic and South American bauxite, is planning to enlarge its fleet of vessels engaged in the South American bauxite trade.

Both the British Guiana and Dutch Guiana bauxites are of extremely fine quality and are admirably adapted not only for the making of metallic aluminum, but for use in the abrasive and chemical industries as well.

In Memory of Alexander Agassiz, for Thirty-nine Years President of the Calumet & Hecla Mining Co.



A Statue of the Man Who Was Chiefly Responsible for the Development of One of the World's Great Copper Mines

THE unveiling of the statue of the late Alexander Agassiz, first president of the Calumet & Hecla Mining Co., took place in Agassiz Park, Calumet, Mich., on Sept. 26. Rodolphe L. Agassiz, now president of the Calumet & Hecla Consolidated Copper Co., who followed his father as president of the Calumet & Hecla Mining Co., was present at the unveiling ceremony.

The statue, the work of Paul Bartlett, a well-known New York sculptor, is of heroic size, the figure of Agassiz being seated in an arm chair, in natural pose. It is a splendid work of the sculptor's art, Mr. Bartlett having reproduced in striking effect the familiar characteristics of face and form of his subject.

It is considered most appropriate that the Agassiz statue should be erected in Calumet, which early felt Mr. Agassiz's kindly and aggressive influence, and that it should have a prominent place in a park named in his honor.

Alexander Agassiz took an active interest in Calumet's growth and development throughout the many years he was president of Calumet & Hecla. In addition to a policy of vigorous development of the properties of the company, he was concerned always with the comfort and progress of the employees and the advancement of the community. In return he enjoyed the highest regard of the citizens.

Points the Mining Speculator Should Study

Money Now Wasted in Hopeless Promotions Could Be Better Spent in Developing Real Prospects—Knowledge Rather Than Legislation Needed

By D. A. Richardson

Attorney, Tucson, Arizona

THOSE WHO have had extensive experience in the business of metal production know that all mining ventures in the early stages of development are highly speculative, and the prospective financial returns must be large in proportion to the risk assumed, or they would not prove attractive to the great number of small investors who furnish the capital for the development of prospects into producing mines. The risk in the business of discovering and developing orebodies of sufficient size and value to make a paying mine can be greatly minimized by the factors which control any successful business—namely, opportunity, experience, knowledge, skill, and money; and all failures will generally show a lack of at least three of these factors, and in their place will be found overconfidence in promotion, ill-advised choice of opportunity, and a shortsighted plan of operation.

Much of the great waste of capital which results from ill-advised and overconfident speculation by the public, in mining and other basic industries, could be saved and turned to useful production by a little thought and careful investigation. So long as progress is desired, speculation will exist, and so long as that inherent trait to get something for nothing remains in human nature losses will result, though legislative restrictions may protect a few of the weak and overconfident ones against the results of their own folly, at the expense of the strong and progressive.

It is estimated that only about one in 750 prospects develops into a paying mine. Knowledge, skill, and experience, careful examination and investigation, and, in some cases, a reasonable amount of well-planned preliminary development work will reduce the larger number to approximately seven; one out of the seven will develop into a large and successful dividend payer. When inexperienced people organize a company to develop a prospect their sole asset is that one prospect; if that one fail, the investment has been a total loss; they have put all their eggs in one basket and taken a 750 to 1 gamble that one fall would not break them all. If proper knowledge, experience, and skill had been used, the capital wasted on 743 such projects could have been saved to the investor and thereby turned into the development of one of the seven prospects found worthy of extensive development.

A great number of people have a small amount of available capital and a strong desire to place it where it will bring them the greatest returns, both as to dividends and increase of principal. The only outlet for such capital is in new corporation securities, either mining, industrial, or transportation, where there is a good speculative chance of greatly increasing the principal by a reasonable speculative risk. But for the average small investor the problem is how to choose the right company and thereby reduce his speculative risks to a minimum.

No hard and fast rule can be laid down, nor any strict law formulated that will wholly protect a human being against his own acts of folly; complete protection is found only in wisdom gained through knowledge and experience. Solomon gave the only answer to the question, when he said, "Get wisdom; and with all thy getting get understanding." If the average investor knew 50 per cent of the facts regarding a mining prospect, he would save his money for a more worthy object. It is true that the average mining prospect does not lend itself to a lengthy report regarding orebodies and their commercial value, for this information is known only for developed mines, but the facts may be ascertained as to why the prospect was chosen for development in preference to the hundreds of others that may have been available. A report should cover all the reason in detail, and such facts should be placed before the prospective investor, with a majority of the following questions answered fully and clearly to his satisfaction.

Property

Does the company hold a complete and sufficient title to the property; if not, how is the company to obtain or acquire such a title in the future? If the company has not a complete title, in whom is the title now invested, and in what office are the records now on file? What value has been placed on the property by those competent to judge of its value? Where is the property situated, and what are the transportation conditions to and from the property? What is the general extent of the property, how is it situated in relation to other producing mines in the same district? What is the production history of the district in which the property is situated?

Geology

What is the general rock formation of the district in which the property is situated? How does it compare with other well-known districts that produce the same character of minerals? To what extent and depth have the oreshoots been proved in that and other districts of like formation? Are the vein systems regular and well defined, or irregular and broken? Is the formation faulted and broken, or is it in place and clearly and well defined?

Topography

What are the main mountain ranges, hills, valleys, rivers, creeks, timber and vegetation, the average altitude, rain- and snowfall, telegraph and telephone communication, commercial power lines, if any; general climatic conditions, and their general effect upon the labor conditions?

Development

To what extent has the property been developed underground, and by whom; and what is the general extent of development in other mines of the district? What is the extent of the development on the nearest

adjoining property, and what has such development produced? What does the development already done on the property prove, and what effect will it have on the future development of the property? By whom was the work done, and who paid for it?

Surface Improvements

What is the general extent and condition of the surface improvements, and how do they benefit the property, now or in the future? What was the approximate cost of such improvements? What is the general extent of surface improvements on other mines in the district? What is the general metallurgical process used in the district, and why is such process of reduction used?

Recommendation

What recommendation has been made for the development and operation of the property and by whom, and what are their qualifications to fit them for making such recommendations? What is the total approximate cost of carrying out such recommendations? What financial results may be reasonably expected when such recommendations are fully carried out? Will the man, or men, responsible for the recommendations have the authority to carry them out fully, or change them later, if future development proves it to be necessary for the more profitable development of the property?

Organization

Under what state law was the company charter secured? What is the total capitalization, and why was such a figure chosen by the organizers? Is the stock fully paid up, and how was this accomplished? Is the stock assessable or non-assessable? Is there any stockholders' liability? Is there any preferred stock, or any stock with any preferential rights? What amount of stock was originally placed in the treasury, and what amount is still remaining in the treasury? How many men together hold controlling interest in the outstanding stock, and how did they secure such control?

Management

What is the number of and what are the names of the men composing the board of directors; what are their qualifications for such position; and what are their businesses outside of the company? How many of the directors take an active part in the management of the company other than attending board meetings? Who are the active officers of the company and what are their qualifications? What officers give all of their time to the management of the company affairs; what salary do they receive, or other compensation for their services? What are their qualifications, and is such salary or other compensation reasonable and adequate for such services?

Finance

What are the general extent and value of the company assets? What royalties, rents, debts, payments, present or deferred, or other obligations are to be met and carried by the company? Why is the company selling stock, and approximately how many shares are expected to be sold before the company is placed in a self-sustaining position? What part of the money received from the sale of stock actually goes into the treasury? What part of the money going into the company treasury is actually to be spent in the development of the property?

Is the price at which the stock is now offered reasonable, and why? Are there any valid reasons for expecting an early advance in the price of the stock? Will the stock be listed on a reputable stock exchange within a reasonable time? How does the price at which the stock is now being sold compare with the price of stock on projects of like nature? What dividends have been paid by the leading companies in the same district, and in other districts of like nature? How does the project compare generally with others of like nature? What profits may reasonably be expected, when all of the plans of the company are fully consummated?

Costs of McIntyre-Porcupine Gold-Mining Operations

An unusually clear and thorough picture of the cost of gold mining in the Porcupine district, Ontario, is given in the annual report of the McIntyre-Porcupine Mines, Ltd., for the year ending June 30, 1923. In the operating year 240,615 tons of ore was treated, of an average value of \$9.96 per ton and a gross value of \$2,397,303. The total bullion recovered amounted to \$2,249,741.63, or \$9.35 per ton of ore milled, and contained 107,997.36 fine ounces of gold and 26,377.86 fine ounces of silver.

Analysis of Mining Costs—Per Ton Milled

	Cost per Ton
Labor.....	\$1.3825
Explosives.....	.4249
Supplies.....	.2346
Power.....	.2429
Timbering.....	.2605
Steel sharpening.....	.1099
Drill repairs.....	.1056
Surveying and engineering.....	.0562
Sampling and assaying.....	.0706
Pumping and ventilating.....	.0620
Tramming.....	.1413
Hoisting.....	.4080
Less charged to deferred development.....	\$3.4990
	.3035
Exploration.....	\$3.1955
	.0802
Examination of prospects.....	\$3.2757
	.0486
	\$3.3243

The new mill addition was ready on Nov. 1, but owing to a shortage of hydro-electric power, was not operated at capacity until May. The milling costs for the period are \$1.11, against \$1.03 for the preceding year. The increase of 8c. per ton is due to the mill not operating to full capacity, the shortage of hydro-electric power, and the generation of power by steam to operate part of the plant.

Milling Costs

	Cost per Ton
Ball milling.....	\$0.1745
Tube milling and classification.....	.3016
Pumping and elevating.....	.0758
Agitation.....	.0525
Thickening.....	.0678
Clarification.....	.0518
Precipitation.....	.0727
Reagents.....	.1616
Refining and assaying.....	.0739
Heating.....	.0619
Tailing disposal.....	.0110
Total.....	\$1.1051

Operating Costs

Mining	
Exploration.....	\$0.08
Development.....	1.01
Breaking and stopping.....	2.18
Examination of prospects.....	.05
	\$3.32
Crushing and transportation of ore.....	\$0.20
Milling.....	1.11
Heating and maintenance, buildings and camps.....	.14
Mercantile store and welfare expense.....	.08
Management and general expense, mine office.....	.24
Administrative and general expense, head office.....	.33
Transfer and registrar expense.....	.04
Insurance—general.....	.08
	\$5.54

The By-laws of the Canadian Institute

By T. A. Rickard

THE Canadian Institute of Mining and Metallurgy has proposed sundry amendments to its by-laws. These amendments are phrased so unhappily that Mr. H. E. T. Haultain, the professor of mining in Toronto university, offered a prize of a copy of Peele's Handbook to the student that wrote the best interpretation and comment. He asked me to act as judge, and I awarded the prize to Mr. W. S. Maguire. All the papers that were submitted showed a vigorous critical faculty, but most of the writers erred in being meticulous. One must not expect too much from the Council of an Institute! For example, according to the proposed amendment, members must have been "for at least five years in responsible positions with regard to practical mining and metallurgical work." We can overlook the use of such ambiguous adjectives as "responsible" and "practical," because most of us know the sense in which they are used in such a context; but "with regard to" is lamentable. It suggests the vaguest kind of connection with mining or metallurgy, and could include those engaged in the allied industries, such as the manufacture of machinery, the making of cement, or the selling of shares in mining enterprises. However, the attempt to define eligibility is rendered supererogatory because the next clause provides for the admission to membership of "such other persons as shall be otherwise eligible in the opinion of the Council."

Associates are to be recruited from "persons engaged in practical mining and metallurgical pursuits and shall have been so engaged for a period of three years at least." This likewise is generously vague, for it includes every man who for the specified period has been on the payroll of a mine, mill, or smelter. To stretch the comprehensiveness of the associateship the next sentence extends an invitation to "such other persons as the Council may decide to be eligible through connection with mining affairs," which, of course, includes professors, promoters, brokers, stockholders, accountants, and secretaries of mining companies. These Associates "shall be entitled to vote, but may not hold office," thereby suggesting a contingency in which a motley crowd might dominate the affairs of the Institute.

Student members are described as "persons not under eighteen years of age, and not over twenty-five years of age, who intend to adopt the profession of mining or metallurgical engineer." Obviously intention is a poor criterion: it would be better to describe such candidates as students in mining colleges, whereupon the age qualification would become unnecessary. As they are intending "to adopt the profession," they must be preparing for it in the usual way—by a technical education. Such junior membership apparently is not meant for the sons of laborers or artisans, even though they "intend" to win "responsible positions with regard to practical mining and metallurgical work."

These are my criticisms, and in the main they are those proffered by Mr. Maguire, who, however, closed his statement with a pungent observation: "Associate membership is placed on a trade-union basis." So is membership. The Institute ceases to be a professional society. The reasons for the change have been made clear during the course of the lively controversy that has been in progress during the past year, the chief

argument being the need for a larger revenue, which is required to meet the cost of the increased publishing activities of the Institute. Another is the wish to make the Institute more "representative"—that is, to include a larger number of the persons interested in mining that are not professional men and that make no pretence to the possession of a technical education. In short, the Canadian Institute is to become a Mining Congress. A similar trend has marked the expansion of the American Institute, although it must be acknowledged that the development in that direction on the part of the Canadian society has the justification, which our Institute has not, of the original purpose of its organization, for it was started as an association of mine operators desirous of co-operating in self-protection against excessive taxation and other menaces arising from adverse legislation.

Apparently the inevitable has to be faced: the acceptance of the trade-union idea. This has been adopted frankly by the American Association of Engineers, which now claims the largest membership among organizations of this character within the engineering occupation. I use "occupation" advisedly, for the idea of profession is subordinated to that of a more comprehensive category. The plain fact is that neither in Canada nor in the United States can the professional mining engineers be organized in number sufficient to meet the cost of the exuberant publishing to which those in control of our Institutes have committed themselves. The only truly professional organization of mining engineers on the American continent is the Mining and Metallurgical Society, which restricts its publications to small volume, and even it has done so much—and well—that it has been compelled by the exigencies of finance to levy an occasional special assessment for the purpose of meeting the extra expense that such publishing activities entail. The end is not yet. This comparatively recent urge on the part of technical societies to issue magazines and to engage in copious publications is a symptom of the modern desire—or weakness, as you will—for two things, one of which is mere bigness and the other lavish publicity. The craving for publicity has become a characteristic of modern life; it has been fed by the daily press to the point where it is an obsession, detrimental to the self-respect, and even the usefulness, of individuals as well as of the aggregates represented by organized groups of men and women. In time it will be corrected by two factors: a realization of its cost and of its futility, as regards the functions that such technical societies are meant to perform. Much of the urge for publicity is fed by the desire of the few in control of headquarters to have a mouthpiece through which their own ideas may be impressed on the scattered membership without incurring the responsibilities of real journalism, which is not subsidized, as are the magazines issued by the Institutes. They are "subsidized" because they are maintained out of funds collected for the other, and more essential, purposes of the organizations; they are a byproduct issued at the expense of the inarticulate majority of the members of the Institutes. To meet the cost the bars of membership must be lowered, so that the societies become non-descript in character.

DISCUSSION

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Bandit Taxation and Depletion

THE EDITOR:

Sir—In your editorial of June 9 you advance some theories in criticism of the new Minnesota tax on iron ore from which I beg leave to dissent. Perhaps the worst confuser in popular economic discussions is the loose use of the word "capital" where no distinction is made between the true and the fictitious article. In J. E. Symes' political economy "capital" is defined as: "Such material products of labor as are devoted to the production of the objects of desire." It is therefore clear that "land" (natural resources) is *not* "capital" but, as Symes states, "such material gifts of nature as can be monopolized." A title to land therefore does not create capital, but simply gives its holder the right to monopolize a gift of nature.

If all land were of equal productive value and there were plenty for everybody who wanted to use it, the allodial or absolute private tenure of land, which modern civilization has inherited from imperial Rome, would have nothing unjust or undemocratic about it. Unfortunately, however, the land is very unequal in its productiveness (whether it be that conferred by nature or that due to social location), as is evidenced by the fact that a bare acre in the townsite of New York City or in the mineral zone of Butte may be valued in the millions, though vast stretches in the arid West will not even yield working expenses and are therefore worthless to the title holder.

The problem of an equitable land distribution, though early perceived by the Gracchi and other reformers, was never resolved in the ancient republics, and it has remained for modern scientific economists, beginning with the Frenchmen, Turgot and Quesnay, and the Englishmen, Smith and Ricardo, and ending with the American philosopher, George, and his practical disciples, Sherman and Fillebrown, to answer the riddle as follows: "Cease levying taxes on private property—labor and capital—and collect them all from public property—natural resources." Unfortunately, however, for modern republics, they are not dominated by scientists but by lawyers, who are the slaves of precedent and wedded to the Roman allodial tenure, which produced that plutocracy which ruled and finally ruined the ancient civilization.

Now, to return to our muttons—the taxation of minerals. In their idea that mineral deposits, like other natural resources, are an unalienable national heritage, the legislators of Minnesota are clearly in accord with the ethical theory of property that I have outlined. But in the practical application of the theory they are evidently at fault, if they have levied a 6 per cent tax on the value of the *gross* output of ore. The "land" value

of the ore is not its value when ready for shipment but what it is worth in the ground. In the case of the Mesabi range, where the whole expense of prospecting as well as that of development is usually thrown directly on the operator, this land value, at the date of the lease, is the same as the royalty to be paid to the fee owner or landlord.

With your statement that a level tax on gross output will increase the cost of production I am heartily in accord. But a tax on royalty (the value of ore in the ground) cannot affect costs, because the rent of land is only the *residual* remaining after the *essential* costs of production, the wages of labor and the interest of capital, have been paid. It is therefore merely a question of *who* gets the royalty; the essential cost of the output will be the same in whatever way the royalty may be divided between the fee owner and the government. I agree with you again when you state that the iron ores of Minnesota are essentially a national rather than a purely local asset. And the ideal application of ethical taxation would mean that each of the four units (nation, state, county, and town) would be supported principally from its proportional share of the revenue arising from taxing the value of the local natural resources, including ore deposits. But until the theory of ethical taxation is better understood by the federal lawmakers, the town solons can hardly be blamed for profiting unduly from their local ore bonanzas.

As an example of the astonishing ignorance of our lawyer Congressmen of the true principles of democratic taxation, I will cite the case of the "depletion" allowance now permitted to mine owners in their return for the federal income tax and which you discuss in your editorial of June 2. A mine's income can only proceed from three sources: (1) The rental, or royalty, value of its ore; (2) the interest on its true capital represented by the investment in development and equipment; and (3) the wages, or administrative profit, due to the special ability of its managers. The allowance for depletion is based on the popular misconception that the royalty value of ore represents a part of the mine owner's "capital," when to an economist it is simply: "a material gift of nature monopolized by legal title." The exemption of the miner's first source of income (royalty value) from the income tax implies that the tax is levied solely on the other two sources—his capital and labor. We have thus the reverse of ethical taxation and the ludicrous phenomenon of various rich mines which are showing little or no income subject to the federal tax while they are at the same time yielding millions in dividends to their shareholders.

That my fellow mine owners need not be unduly alarmed by my proposals, I will explain that the initiation of ethical or natural taxation would not mean that the mining industry as a whole need pay a larger sum for public purposes than it does at present. It would merely imply a different distribution of the burden. Mines of lean ore of no value in the ground would

never pay anything, nor would rich mines in the development stage which had not yet begun to realize profits. In compensation, the producing bonanzas (after an allowance for the interest and amortization of their true capital) would pay out as taxes a fair share of their royalty values. Finally, the abolition of the tariff and of all other forms of indirect taxation would greatly lower the cost of supplies for operators and the cost of living for miners.

ROBERT BRUCE BRINSMADÉ.

Ixmiquilpan, Hidalgo, Mexico.

“Concerning Rich Ore”

THE EDITOR:

Sir—It was with much interest that I read the article by Mr. Rickard in your issue of Sept. 1, “Concerning Rich Ore,” and as there was not a mention of the marvelous rich faces that were to be seen occasionally in the National mine, in northern Nevada, at the time it was at its best, I cannot refrain from writing a few lines concerning it.

I have mined and mined, but never have I seen such bunches of ore as were to be seen there at different times in the Stall brothers’ lease in the year 1910. I was only a timber man at the time, and had no way of telling how much the ore was worth except through hearsay, but Mr. Cutler, the superintendent, told me that it was worth from \$50 to \$70 per pound, and Mr. Williams, a relative of the Stall brothers, who was mine foreman, vouchsafed the same information.

I remember one face in particular that was about eight feet high and was about two feet wide at the top and one foot wide at the bottom that probably ran from \$50 to \$70 per pound. There was one piece taken out of this face that was so large that it required two men to roll it onto a timber truck to get it to the shaft, and it was all that two of us could do to roll it into the skip to be hoisted. I would think that it was in the neighborhood of 70 per cent metal.

There was another bunch of about the same size and richness in the bottom of the shaft at the time the Stall brothers were caved on and had their legs broken.

I doubt if there has been another mine in the world that produced as much gold with as small expenditure of labor as the National mine did in 1910.

Randsburg, Calif.

ATHA A. RICHIE.

Buck-passers and Foolproof Mines

THE EDITOR:

Sir—Two articles have recently appeared in the *Journal-Press* that have been intensely interesting, because both of them were super-critical of common conditions of mismanagement. I refer to the story of the “Buck-passer Mine” and “When a Mine Is ‘Foolproof.’” Perhaps there is a little more in both of those articles than we are ready to admit. The most of us are inclined to say “It isn’t intended for me” when we read such articles, just because the author put some condition around the story to make identification impossible. I can imagine how sore I would be if either of those articles had laid their scenes around the mine which is under my management. After reading the “Foolproof” article in the issue of Sept. 1, I dug up the issue of June 2 and read the “Buck-passer” story carefully, and then I asked myself several questions. Am I egotistical? Am I an excuse maker? Do I make excuses and explana-

tions for costs that can be reduced? Do I pass the buck? Then I sat down to analyze my operations and I think I have benefited by so doing. I divided my payroll into three parts—non-producers; service men, who give service that the producers can work; and actual producers; and then I discovered that my non-producers and service men cost nearly twice as much as my actual producers. The following figures are actual figures on Sept. 10, 1923, and I came to the realization that I was running a foolproof mine, for it was producing a profit:

A Division of Actual Salaries and Labor Costs at a “Foolproof” Mine Sept. 10, 1923

Non-productive Labor	
General manager	\$33.33
Mine superintendent	20.00
Stenographer	4.00
Purchasing agent	6.66
Bookkeeper	5.50
Mine surveyor	7.00
Survey assistant	5.00
Office boy (messenger)	4.00
Storekeeper	5.50
Store assistant	5.00
Roustabout-janitor	4.00
Pipe-fitter foreman	6.00
Pipe fitter	5.50
Pipe fitter	5.50
Electrician	7.00
Electrical worker	5.50
Electrical worker	5.50
Blacksmith (general)	6.00
Blacksmith helper	5.00
Steel sharpener	6.00
Timber framer (boss)	7.00
Sawmill worker	5.50
Sawmill worker	5.50
Timber-yard worker	5.00
Timber-yard worker	5.00
Master mechanic	10.00
Machinist	6.00
Machinist	6.00
Machine-shop helper	5.00
Machine-shop helper	4.50
Truck driver	5.00
Truck driver	5.00
Top laborer boss	5.00
Top laborer	4.50
Top laborer	4.50
Compressor man	5.00
Compressor man	5.00
Compressor man	5.00
3 Hoist engineers at \$6.	18.00
3 Winze hoist engineers at \$6.	18.00
Incline hoist operator	6.00
2 Ore-bin loaders at \$4.50	9.00
Watchman (night)	4.50
	\$305.99
Productive Labor	
30 Stope miners at \$5.50	\$165.00
10 Development miners	55.00
11 Trammers at \$5.	55.00
15 Muckers at \$4.50	67.50
	\$242.50
Service Labor	
1 Tool nipper	\$4.50
2 Track sprinkler	9.00
3 Fire watchers	13.50
3 Shift bosses at \$6.	18.00
3 Timber men underground	17.00
5 Ore sorters	22.50
3 Motor haulage men	15.00
3 Pump men at \$5.50	16.50
3 Cagers at \$5.	15.00
	\$124.50

I wonder what my board of directors would say if I’d send in a report like this. I wonder how many mine superintendents or managers would dare to make their annual reports like I’ve made this one. Let me assure you right now that my own annual report never has shown this, but never again will two-thirds of my expense be in non-productive and service labor accounts.

Nor is this all. There have been times when I’ve had extra men engaged on surface improvements, whose pay would be averaged in with a yearly report. It would be safe to add \$10 a day more to the “non-producers” to

cover these extras. If my board of directors should direct me to "cut down expenses" I now have a knowledge of where to study out a place to reduce them. Cutting wages of the producers, or laying off a few miners, reduces the tons produced, and the cost per ton increases. In addition to this, a similar division of "Expenses not labor" into non-productive expense, service expense, and productive expense brought equally startling ratios.

I want to thank the writers of those two articles for telling me that I was egotistical, self-satisfied, or whatever it was that was the matter with me. I found out something by looking at my own work. I've been twenty years in charge of mine work, and I'm not the only one that the shoe fits. I know that by observation of work at other mines.

Is it any wonder that some mines do not pay? If my own mine wasn't a foolproof mine it would have been shut down before this.

I hope you can get a number of others to make similar divisions and comments on Mistakes in Mine Management, and I surely will benefit by them, and hope others will.

MINE MANAGER.

Advice to Canadian Asbestos Producers

THE EDITOR:

Sir—I notice in your issue of Sept. 29 an article headed "Senseless Competition Causes Dividend Cut by the Asbestos Corporation." Mention is made therein that shipments of asbestos have shown an increase this year over last, and that the prices have been considerably reduced, owing to senseless competition among the Canadian companies. This is a deplorable condition which receives too little attention by both the Canadian asbestos industry and people outside of it.

The Canadian Government Natural Resources Intelligence Branch shows a total production of 110,445 tons in 1921, and, according to my figures, the production in 1922 was considerably greater. They show, however, that Rhodesia in 1921 produced 19,529 tons. Considering that this 19,000 tons consisted chiefly of long fiber, easily explains the fact that Canadian stocks on hand at the end of 1922 consisted of 3,865 tons of Crude No. 1 and No. 2, and 10,860 tons of spinning fibers. Therefore the falling off in demand for the higher grades is not partly owing to Rhodesian competition, but, in my opinion, entirely due to that factor.

That Canada produces the best chrysotile asbestos in the world is well known. But for the fact that the miners in Canada pursue a narrow-minded policy of cut-throat competition and refuse to discuss for their mutual benefit a cure, they can blame no one but themselves. As long as such competition continues, the situation will remain the same.

Considering that Canada produces by far the greatest tonnage of asbestos and that the United States takes practically all short material up to, but excluding, shingle stock, I can see no reason why the miners operating in Canada do not get together and establish prices on low-grade materials on a reasonable plane. I am quite sure the manufacturers in the United States would not hesitate to pay the advanced prices and allow the Canadian miners to make a fair return on their investment, provided everyone paid the same price.

If the Copper Export Association, which was primarily formed to dispose of surplus stocks and to sta-

bilize prices abroad, is able to function successfully, why cannot an association of this kind be formed in Canada? Why do not Canadian producers realize the foolish policy which they are now pursuing and raise their prices, especially on low grades, where they have absolutely no competition, so that they can show a fair earning? As it was well put by a large manufacturer to me not so long ago, Canadian producers made one mistake: instead of reducing prices promptly in 1918, when the war ended, they maintained them at such a level that they allowed Rhodesia to continue operations. Canadian producers have no one to blame but themselves for allowing Rhodesia to get into the market and compete with them. The tremendous prices demanded for the Canadian product during the war enabled Rhodesian operators to establish their business. This manufacturer furthermore stated that he preferred Canadian raw asbestos, but the prices had to be at least on a par with those of Rhodesia. Therefore it behooves the Canadian miner to cut prices on crudes and long fibers to such a point that Rhodesian asbestos will be removed from the market, and to raise prices on short fibers to a point where there is no competition, to enable him to recover whatever loss he may make on the long product. The ratio being at least 4 to 1, or greater, this is a simple thing to do.

The labor situation in Canada is one which is also unsatisfactory. The mines outbid one another for the available labor, and are helpless in case of a strike to get together for mutual protection. When one considers that Canadian laborers earn in one day what African laborers get in one month, one sees how necessary it is to form an association among Canadian producers.

The best cure, in my opinion, for this state of affairs is for two or three of the larger miners to form an association and to take from the small miners their production, thereby preventing price-cutting competition. As there are so few mines in the district, it would also be possible to form a company to take over all the properties except those controlled by manufacturers in this country and operate them under one unit, reducing overhead, simplifying methods of treatment, and, above all things, reducing overproduction and standardizing grades.

The 18,000-odd tons of long-fiber Rhodesian presently being produced would quickly be eliminated if the Canadian miner would take heed and bring his prices to the same level as those of the African miners. Canada is situated geographically much better to reach the world's market than Africa, and is in a position to compete with any part of the world, particularly with favorable freight rates. It certainly should be able to do so on long fiber, having nothing to fear on shorts.

The article states that the company mentioned is in a strong financial condition and is therefore in an excellent position to meet competition until such a time as the other mining companies change their attitude. This may be true, but the question arises in my mind as to how long the attitude mentioned may continue. If it continues long enough, and the company in question meets the competition, its surplus will be reduced quickly.

It seems too bad that an industry in such few hands as the Canadian asbestos industry cannot see beyond its nose when it has the opportunity to place itself on the same basis as other large industries where competition is more severe, as, for example, the paint industry.

New York City.

"AMIANTHUS."

Recent Technical Publications

Reviews, Abstracts, and References

A Textbook for Chemical Engineers

Principles of Chemical Engineering. First edition. By William H. Walker, Warren K. Lewis, and William H. McAdams. McGraw-Hill Book Co., New York. Price \$5.

For some time there has been a lack of a satisfactory textbook on chemical engineering; the rapid technical advances in applied chemistry have robbed the earlier books of much of their usefulness. This book covers its field well, but it must not be expected that any detailed discussion can be incorporated in a book of 600-odd pages that treats of such a broad subject as chemical engineering. If one wants to know how such a common material as soda ash is made, for example, he will not find out in this book. There is no such word as soda in the index. Rather do the authors enumerate the principles of the science as a whole and then develop methods for applying these principles and describe briefly the equipment that is used. The first chapter, then, is devoted to stoichiometry—to a study of how the elements combine, what the products will be, and how to express the reactions in figures. Then follow chapters on fluid films; flow of fluids; flow of heat; fuels and power; combustion; furnaces and kilns; gas producers; crushing and grinding; mechanical separation; filtration; vaporization; evaporation; humidity and thermometry; drying; and distillation.

The book is essentially intended for the college student, for whom it is well adapted. Most of our readers who might be interested in such a book are practical metallurgical engineers and they will not find a great deal in the volume that is not available in greater detail elsewhere. The chapter on crushing and grinding, for example, will not be particularly illuminating to them, and the page in which the flotation process is discussed could have been vastly better written. Some evidences of carelessness are noticed, such as a mix-up of the Marcy and Allis-Chalmers ball mills in text and illustrations, and misspellings of Symons and Newaygo. But chemical engineers tell us that the book is a very excellent one and we see no good reason for contradicting them.

E. H. ROBIE.

The Mining Catalog (Metal and Quarry Edition). Third issue, 1923. Keystone Consolidated Publishing Co., Inc., Pittsburgh, Pa. Price \$10, except to mining companies and mining engineers furnishing the publishers with certain data as to their operations.

"The Mining Catalog" has already made a place for itself in mines, mills, and smelters of the country, for it is a fairly comprehensive reference book wherein may be found the names of

the principal manufactures of mining and metallurgical equipment, with a condensed description of their products. There is a considerable amount of engineering data interspersed in the catalog pages, so that the book also has somewhat the scope of a handbook. The only fault that we have found with the book is that we already know the names of the principal manufacturers and what they make, and it is usually the name of some small manufacturer that we require. As most of such have no appropriation for advertising, their names are not included. For example, we have just had an inquiry as to the names of manufacturers of dry concentrating tables. The only ones that we know are Sutton, Steel, & Steel, and the Stebbins Engineering Co., neither of which is given in the book under review. One of the features of the book that we mentioned last year—a good reference list of technical books, with the date of publication—is again included. No mining company should have difficulty in securing the book without cost, and it is worth sending for.

An Introduction to Mining Science. By J. B. Coppock and G. A. Lodge. Second edition. Longmans, Green & Co., New York. Price \$1.35.

This is an English book for the beginner in the study of mining engineering. It is principally devoted to safety and ventilation, particularly of coal mines, and contains numerous directions for laboratory experiments.

Helium—A paper recently published by the A.I.M.E., 29 West 39th St., New York City, tells of what the government has done about the production of helium, the plants used for its recovery, the research work that is being done, the uses to which the gas will be put, and a few words about the origin of the gas. It has become important as a filler for dirigible balloons, it being non-inflammable.

Mine Ventilation—"Ventilation and Dust Control in Metal Mines," a paper contributed to the Pan-Pacific Science Congress held at Melbourne in August, 1923, is published in part in *Chemical Engineering and Mining Review* for Sept. 5, 1923. (Melbourne; price 11d.). The paper is by P. H. Warren, and the first instalment includes the introduction, and a description of the use of the Kata thermometer. It will be continued in future issues.

Mineral Resources—Recent issues of separate chapters of "Mineral Resources" include: "Talc and Soapstone in 1922," 6 pages; "Silver, Copper, Lead and Zinc in the Central States in 1922," 31 pages; "Potash in 1922," 21 pages; and "Platinum and Allied Metals in 1922," 11 pages. Any of these may be obtained from the U. S. Geological Survey, Washington, D. C., on request.

Emergency Power for Mines—A 5-page paper under this title has been issued by the A.I.M.E., 29 West 39th St., New York City. It describes a gasoline-engine driven unit that may be used to bring the men out of a mine when the regular power supply fails, and also to keep the mine clear of gas until the men are all out.

Mine Timbering—Bulletin 215 of the U. S. Bureau of Mines, Washington, D. C., 72 pages, obtainable on request, is a practical manual on the methods of timbering in underground metal mines. The bulletin aims to answer the following questions: "Under what conditions is timbering necessary in mining? What are the principles governing its use? Which kinds of timber are best suited for mine use? What are the best methods of timbering the various mine openings? What determines the different methods of framing? and Should preservatives be used on mine timbers? The booklet is well illustrated and should be of great practical value, especially to the small or inexperienced operator.

Drag Scrapers at the Utah-Apex—"Loading Ore Underground With Scrapers at the Utah-Apex Mine" is the title of a 7-page illustrated paper just issued by the A.I.M.E., 29 West 39th St., New York City. A brief description of the drag scrapers and small hoists that have been used at this mine is given. Savings have been made and larger and heavier equipment is being installed.

Copper Refining—The precious metals are an important byproduct of blister copper. How they are recovered at the Raritan plant is told in a 5-page paper in *The Anode* for June 15. (Anaconda Copper Mining Co., Butte, Mont.) Both the Thum and Moebius systems are used.

Anti-friction Bearings—A paper on "Anti-friction Bearings in the Steel Mill" was presented before the Association of Iron and Steel Electrical Engineers some time ago. That and the accompanying discussion are now available in a 51-page booklet issued for free distribution by the Reliance Electric & Engineering Co., Cleveland, Ohio. The advantages and disadvantages of the anti-friction and oil-ring types of bearings are covered, and the paper is of interest to users and designers of machinery in other industries than that of steel.

Queensland Mining—The annual report of the Under Secretary for Mines for 1922 has been issued by the Government Printer, Brisbane, Queensland. The report covers 138 pages and may be obtained for 3s. 6d.

Ecuador Oil—"Cherts and Igneous Rocks of the Santa Elena Oil Field, Ecuador," is the title of a 17-page paper recently published by the A.I.M.E., 29 West 39th St., New York City. The rocks are of Cretaceous age and wells have been sunk to a depth of 2,500 ft. Many photomicrographs are presented.

SOCIETIES, ADDRESSES, AND REPORTS

No Alarm Felt About Petroleum Scarcity

United States Supplies, and Has Furnished So Far, 60 per Cent of World's Requirements—Russia a Big Potential Producer

THE STATUS of the world's petroleum supplies and of the petroleum industry is discussed in the report of the subcommittee on petroleum, of the Committee of Foreign and Domestic Mining Policy, of the Mining and Metallurgical Society of America. The subcommittee consists of A. C. Veatch, chairman; A. W. Ambrose, U. S. Bureau of Mines; Van. H. Manning, American Petroleum Institute; C. W. Washburne; and David White, U. S. Geological Survey.

The report does not undertake to estimate the oil resources of the United States or of the world, but in general terms discusses the subject as follows:

"The oil resources of the world are doubtless much larger than the recently published estimates, and improved methods of recovery should enormously increase the difference. It is now demonstrated that commercial petroleum may possibly occur in sedimentary rocks from the Cambrian to the youngest, if the alteration has not gone too far, and in any structural position. The sedimentary rocks occupy the greater part of the earth's surface. Those found in the United States are but a small part of the sedimentary rocks of the world as a whole. It is only in the United States that these sedimentary rocks have been extensively developed for oil, and, great as the development has been here, the oil in the sedimentary rocks of the United States is by no means exhausted. The conclusion may be stated proportionally: as the ultimate production of the United States is to the area of the sedimentary rocks of the United States, so the ultimate total oil production of the world is to the whole area of sedimentary rocks of the world.

"It has so happened that, for various reasons, the oil deposits of the United States have been more fully developed than those of any other part of the world. American temperament, American initiative, the demands of our own phenomenal industrial and social development, have all been factors. The oil industry of the United States is generally regarded as dating from the Drake well in 1859, during which year the total production of the United States is given as approximately 2,000 bbl. Many other countries preceded us in the commercial utilization of petroleum—China, Japan, Burma, Russia, Galicia, Rumania. In 1819 the production of Baku was approximately

30,000 bbl., most of which was exported to Persia, and earlier still it is recorded that in 1797 there were 520 producing oil wells in Burma, with a yield of approximately 600,000 bbl. per year.

"Such was the activity following the completion of the first Drake well that the United States in a short time came to the head of the list of the petroleum-producing countries of the world. The industry developed so rapidly that, from a minor and insignificant one, it now ranks among the first half dozen of the great industries of this country.

"The annual crude production of the United States at the present time is more than 60 per cent of the annual production of the world—in other words, it is more than that of all other countries combined. The grand total of its production since 1859 is also over 60 per cent of the entire amount of petroleum that has been commercially removed from the whole earth.

"It inevitably follows from these facts that the supply of petroleum in the United States is relatively more nearly exhausted than in other countries.

"The intensity of the development and the effectiveness of the methods used have resulted in the establishment of a large export business. American petroleum has been supplying many countries, which it is safe to say have petroleum deposits at home that are more than sufficient to meet their needs, but which, through various causes, have not been developed. This returns us to the fundamental consideration that at any given moment mineral movements are dependent on the geographic distribution of the developed deposits, and the character of the development in each case, rather than on the actual distribution, extent and richness of the deposits themselves.

Russia, for example, possesses petroleum deposits of great extent and richness, which probably surpass in these respects the deposits of any other part of the world. There are indications that they exceed those that have already been found and those that will be proved to exist in the United States. There was an established oil industry in Russia long before there was one in the United States, and thus, for this period, Russia displaced the United States as the greatest petroleum-producing country in the world, yet, despite all of these facts, the Russian Government for several years prior to the outbreak of the war found it necessary to import

Mexican oil at Batoum. This was due not to any design on the part of the Russian authorities, but simply to a faulty conception of economic principles which resulted in exorbitant taxation and the enforcement of laws not suited to petroleum development which so choked and arrested the development of the home industry that it was found necessary to supply the deficit."

The subcommittee on petroleum, in closing its report, recommends that the Mining and Metallurgical Society pass resolutions urging the support of the State Department to American petroleum companies operating abroad.

A.I.M.E.'s New Petroleum Division Meets in Tulsa

On Oct. 11 and 12, during Exposition Week in Tulsa, Okla., the first meeting of the newly formed Petroleum Division of the American Institute of Mining and Metallurgical Engineers was held in the High School auditorium. The organization of this new division was prompted by the necessity for some common ground where the engineer and the "practical" production man could meet and discuss the problems which confront them. The hazard entailed in the search for oil has been materially reduced by the collection and distribution of knowledge through the geologists' associations; and the management and marketing branches have greatly increased their efficiency by reason of team work through their various societies.

The work of recovering the oil after the geologist finds it has made but indifferent progress. It is true that much advance has been made, but nothing like that which is possible if there were team work to aid individual effort.

The organization of the Petroleum Division was carried out with the idea of meeting this need, says an official announcement. The plan of organization provides for the formation of local groups for the consideration of local problems and the collection and distribution of information thus acquired through a central agency. In using the already long-established institute of mining engineers as a central medium many of the financial and other problems incident to the formation of a new society were largely eliminated.

The initial meeting, which was national in scope, was planned around the subject of handling oil on leases. Papers were presented dealing with the treatment of cut oil by the various processes now in use, evaporation losses, separation of gas, and others which are vitally important.

MEN YOU SHOULD KNOW ABOUT

S. H. Ball is in Brussels.

C. W. Boise is en route to Europe from West Africa.

W. Spencer Hutchinson is making a visit to New York City.

Fred J. Siebert has returned to Reno from an examination trip to different parts of California.

R. G. Hall, metallurgical and chemical engineer, has opened an office at 835 Hyde St., San Francisco.

John G. Kirchen, general manager of the Tonopah Extension Mining Co., is in Los Angeles from Tonopah.

Morton Webber was recently in San Francisco, having been to British Columbia on professional business.

A. H. Burroughs, Jr., general manager of the Talache mines, Talache, Idaho, is in New York City for a brief visit.

Edgar L. Newhouse, Jr., manager of the Salt Lake office of the American Smelting & Refining Co., is in New York City.

E. H. Robie, assistant editor of the *Journal-Press*, left New York this week to visit mining districts in Missouri, Arizona and Mexico.

W. G. Swart, of Babbitt, Minn., vice-president and general manager of the Mesabi Iron Co., has returned from a three weeks' business trip in the East.

Forest Rutherford, mining engineer and metallurgist, has returned to New York from northern Ontario, Canada, where he has been engaged in mine examinations.

Kirby Thomas has been at Ridgway, Pa., where he was engaged in the organization of a company for exploiting a deposit of refractory clay and molding sand.

D. C. Jackling, president of the Mesabi Iron Co., and **Charles Hayden**, of Hayden, Stone & Co., were recent visitors to the plant of the Mesabi Iron Co. at Babbitt, Minn.

Louis S. Cates, of Salt Lake City, Utah, vice-president of the Utah Copper Co., and **D. D. Moffat**, general manager, are visiting the property of the Mesabi Iron Co., at Babbitt, Minn.

C. W. Gudgeon, who has been general manager of the Mount Bischoff Tin Mine, has resigned and **J. H. Levings**, State Mining Engineer of Tasmania, has been appointed to the position.

Arthur Notman, formerly mine superintendent of the Copper Queen mine, of Bisbee, Ariz., but now engaged in consulting work, with offices in New York, is visiting the Globe-Miami district.

Millard K. Shaler will arrive in New York next week on the "Berengaria," to attend further conferences in connection with the educational foundation set up by the Committee for Relief in Belgium.

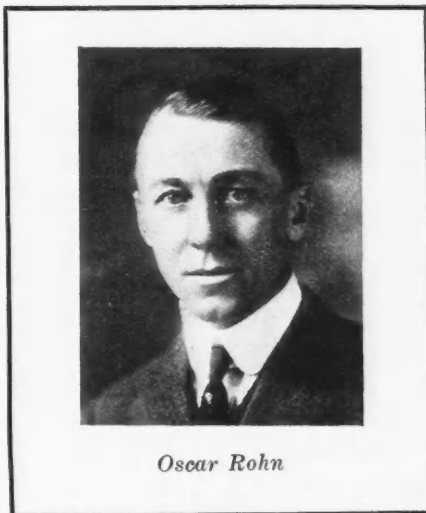
Charles D. Kaeding, president of the Candelaria Mines Co. and consulting

engineer for the Simon Silver-Lead Mines Co., has left his San Francisco headquarters for a visit to these properties.

Dr. G. K. Burgess, director of the Bureau of Standards of the Department of Commerce, discussed the work of his organization in an address on Oct. 17 before the Washington Society of Engineers.

C. P. Bowie, engineer in charge of the San Francisco office of the U. S. Bureau of Mines; **E. C. Lane**, chemist, and **C. E. Steidel**, assistant petroleum economist, recently visited the oil fields of southern California.

Oscar Rohn, whose death was recorded in the issue of the *Journal-Press* of Sept. 29, was, according to information just received, killed in the No. 4



Oscar Rohn

shaft of the Pittsmond, at Butte, while inspecting the operation of a skip-dumping device which he had personally designed.

Leslie Bradford has been appointed works manager of the Broken Hill Proprietary Co.'s steel works in succession to **David Baker**, who is visiting America and will retire from management on his return.

H. G. S. Anderson is in New York City, and plans to remain for some time in connection with the development of the Anderson-Thornhill process for the manufacture of sponge iron, as used at the plant of the Chino Copper Co.

L. R. Robins, superintendent, and **Hal M. Lewers**, chief chemist, of the Tonopah staff of the Tonopah Belmont Development Co., have returned to Tonopah from an extended trip to Colorado properties of this company.

Thomas H. McCarthy, C. E., former head of the Nebraska School of Irrigation, University of Nebraska, has accepted a position as head of the Department of Civil Engineering at the New Mexico School of Mines, at Socorro, New Mexico.

Loftus Hills, director of the Geological Survey of Tasmania, who recently visited London as an Australian delegate of the Returned Soldiers' Imperial Conference, has accepted an im-

portant position in South Africa. He sails at an early date.

Emmanuel J. Jenitzky, metallurgical engineer with the Illinois Steel Co., Chicago, was presented with the H. M. Howe medal for the best technical paper on steel treating during the last year, at the annual banquet of the American Society for Steel Treating, recently held at Pittsburgh.

Edward G. Sheibley has been appointed chief engineer of the safety department of the Industrial Accident Commission of California, succeeding **H. M. Wolfin**. Mr. Sheibley is a graduate civil engineer and has had a wide practical experience in general engineering work.

G. D. Delprat, formerly general manager of the Broken Hill Proprietary Co., has been appointed a director of Hadfields (Australia), Ltd. This company, which was formerly known as the Australian Electric Steel, Ltd., was organized by **J. M. Deschamps** and has large works at Alexandria, near Sydney. It was the pioneer of the electric furnace in Australia.

Alexander V. Dye, of New York City, an experienced mining man, has been appointed commercial attaché of the Department of Commerce at Mexico City, according to an announcement by Secretary Hoover. Mr. Dye is a native of Flora, Ill., and a graduate of Williams Jewell College and of the University of Leipzig. He is intimately acquainted with Mexican economic conditions, having served as United States Consul at Nogales from 1909 to 1913.

Gordon R. Campbell, president, **Thomas Hoatson** and **Ed. J. Collins**, vice-presidents, **James Fisher**, secretary-treasurer, of Calumet, Mich., and **Thomas F. Cole**, of New York; **George A. Newett**, of Ishpeming, Mich.; **Walter Congdon**, of Duluth, Minn.; **William B. Mershon**, of Saginaw, Mich.; **Thomas Colline**, of Princeton, Mass.; **Floyd Augustine**, of St. Louis, Mo., and **Frank Kohlhaas**, of Calumet, Mich., directors of the Calumet & Arizona and New Cornelia copper companies, are making a tour of the companies' properties in Arizona and New Mexico.

OBITUARY

J. Howatt Cooke, of Duluth, a mining man interested in iron and one of the directors of the American Ore Corporation, was killed in an automobile accident on Oct. 18. **W. H. Locker**, of the American Manganese Manufacturing Co., and also of Duluth, was killed in the same accident. They were on their way to the Cuyuna range to make examination of a property in which they were interested and their machine overturned, throwing them under it and on the rocky side of the road. Death was probably instantaneous in both cases. Mr. Locker leaves a wife and children, and Mr. Cooke three children.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary of the Week

THE War Minerals Relief Commission has suspended payment of all awards pending a decision on the remaining claims. Congress may be asked to make a further appropriation over and above the original \$8,500,000 if more is found necessary.

A merger of six asbestos companies in Quebec is proposed by the Asbestos Corporation of Canada.

The Clark Concentrating Co. is erecting plants to re-treat smelter slag and concentrator tailings in the Joplin-Miami zinc-lead district.

Secretary Work's special Advisory Commission on Reclamation meets behind closed doors.

The California Rand Silver, Inc., has opened a wide shoot of good ore between its seventh and eighth levels.

The St. Joseph Lead Co. has purchased the mines of the Federal Lead Co., A. S. & R. subsidiary, in the Flat River lead district in southeastern Missouri. The Federal gets \$10,000,000 and a 30-year smelter contract.

The discovery of a rich, wide vein of silver-lead ore in northern Queensland suggests the possibility of a second Broken Hill in Australia.

Four men were killed by a cave in a wide stope at the Utah-Apex mine, at Bingham, Utah.

Iron-ore production on the Marquette range in Michigan is curtailed by shortage of power.

Extensive improvements of the mine plant at the Soudan mine of the Oliver Iron Mining Co. on the Vermilion range, in Minnesota, are under way.

Good Lead Prices Offset Low Silver in Utah

Grade of Ore Mined in 1922 Much Higher Than in 1913 — Operating Costs Up, Finds Commission

Data on silver production in Utah are being collected for the Gold and Silver Commission of the United States Senate. A. G. Mackenzie, secretary of the Utah Chapter of the American Mining Congress, compared prices of lead and silver as of Oct. 6 with the average of those in 1913. On this basis, silver has decreased 2.6 per cent, and lead has increased 50.2 per cent in price. Mining costs, however, have advanced to a figure 59 per cent above the level of 1913, so that the Utah operator has a smaller margin of profit than he had ten years ago.

Mr. Mackenzie also presented statistics showing a comparison between the grade of the ore shipped in 1922 and that in 1913. In the latter year the ores carried 4.75 oz. silver to the ton and 61.9 lb. lead. During 1922, silver values were 14.22 oz. to the ton and lead 113.2 lb., so that it appears that operators are "high grading" their mines. Utah mines will this year have 16.68 per cent less than last year to pay dividends, federal taxes, and build up a surplus. The operation of Utah silver mines, in the face of high costs and the decreased price of silver, is attributed to the lead content, which is an important factor in silver mining in Utah.

Other men who testified during the progress of the hearing were W. Mont Ferry, of the Silver King Coalition; Oscar Friendly, of the Park City Mining & Smelting Co.; James W. Wade, of the Tintic Standard; Brent N. Rickard, of the American Smelting & Refining Co.; and D. D. Muir, Jr., of the United States Mining & Smelting Co.

Reworks Smelter Slag and Mill Tailing at Joplin

Clark Concentrating Co. Plans Big Program of "Reclamation" in Missouri-Oklahoma Zinc-Lead Field

The Clark Concentrating Co. is building a typical Joplin concentrator just east of the Eagle-Picher Lead Co.'s lead smelter in Joplin, and will attempt to mill the slag that has been accumulating at the smelter for the last fifteen years. Small operators have hand-jiggered the slag for some years with fair results, but R. M. Clark, head of the Clark Concentrating Co., believes much better can be done with a regular mill. He has a ten-year lease on the slag pile and believes he will be kept busy most of the time.

The same company also is building one of the largest tailing mills in the district near tailing piles on a 200-acre lease of the Stratton land, near Douthat, Okla. The piles of tailing were left by the Bethel, Domado, and Croesus mines, and the Clark company expects to build two more tailing mills on the tract in the near future.

Discovery May Mean Second Broken Hill, in Queensland

Lead-Silver Outcrop Enthuses Geologists—3-Ft. Vein Followed 4,000 Ft.—Excellent Assays

What appears to be a remarkably extensive and important find of silver-lead has just been reported from North Queensland. It is 26 miles from Chillagoe, where the government owns smelters and mines, and the report of the discovery is made by the manager of those concerns. The outcrop is said to be about three-quarters of a mile in length, and ten samples taken from spots about 100 ft. apart over that outcrop average from 50 to 70 oz. of silver per ton and 50 per cent of lead. The outcrop stands about 2 ft. out of the ground, and in one place on the top of a hill stands about 15 ft. in height for 25 ft. of length, having 3 ft. of thickness. This has high silver and lead content. It is as yet impossible to say what is under the ground, but a shaft sunk 10 ft. alongside the lode disclosed a solid wall of galena to that depth, and the material is at once to be given a practical test by sending some wagon loads to the state smelters for treatment. The official who reports the discovery says it promises to be the most important silver-lead find in Australia, and may provide North Queensland with a second Broken Hill. A geologist is to be sent up at once to report. Many leases have already been taken up in the vicinity.

Merger of Quebec Asbestos Mining Companies Probable

Asbestos Corporation of Canada Makes Offer to Absorb Five Producers—A \$25,000,000 Corporation Proposed—Centralized Control Desirable

THE Asbestos Corporation of Canada, one of the largest producers in the Thetford Mines district in Quebec, has made definite offers looking to the absorption of five of the smaller companies that are now operating in the district.

Included are understood to be properties controlled by the Consolidated, Asbestos, Baldwin, J. A. Jacobs, Black Lake Asbestos & Chrome, and Asbestos Mines interests. Two of the companies have agreed to terms, while three are not satisfied with the proposal in its present form.

If the merger goes through, it will involve the financing of a \$25,000,000 enterprise, with the Asbestos Corporation at its head. The plans now being developed contemplate, it is understood, the retirement of all the existing bonds and preferred and common stock issues of the various companies that will be associated in the merger, and the issue of new preferred and new common stock on the combined collateral of the various properties as a group.

The Thetford Mines district produces about 85 per cent of the world's supply of asbestos, and since most of the consumption is in the eastern part of the United States, Quebec enjoys definite advantages in respect of transportation costs, a particularly important consideration in connection with the lower grades of fiber. Competition from South Africa is strong; this, however, is confined largely to the "crude" or unmilled product, which brings exceptionally high prices per ton but which is comparatively small in quantity. The great bulk of the profits come from low grade material.

Competition between producers in Quebec has been keen, and in its last annual report the Asbestos Corporation deplored the "senseless competition" as militating against the interests of all of the companies. It is believed that the present step is in the direction of centralizing control of the industry in strong hands, with the end in view of getting co-operation in marketing the product.

A significant fact is the steady expansion in the use of asbestos. It is estimated that in the United States alone there are mills for the manufacture of the crude asbestos with an investment of over \$100,000,000. New uses for the mineral are being found; and one of the latest is for the walls and partitions of houses.

Another factor almost equally important for the Canadian industry is that means have been found to treat the lower grades of ore. This has made of potential value material that previously it was found unprofitable to

handle at all. To such an extent has progress been made in the treatment of asbestos ore that millions of tons that have been thrown out on the dumps of the various mines are now looked upon as containing valuable supplies that it will be quite profitable to treat. This latter factor is important to the Black Lake properties, which in themselves occupy about 5,000 acres and are recognized as the most extensive in the Province of Quebec.

Minas Pedrazzini Changes Power-Plant Site to Nacozari

The erection of the Diesel-Sulzer electric power plant at Cananea, Sonora, Mexico, for the Las Chispas silver mine was discontinued last month. Considerable excavating for the 500 kw. engines had been completed, and much of the machinery had arrived at Cananea. This action was taken on the recommendation of Morton Webber, who was recently appointed consulting engineer for the Minas Pedrazzini. A new power site has been leased at Nacozari from the Moctezuma Copper Co.

The distance from Nacozari to Las Chispas is only 45 km., as against approximately 100 km. from Cananea. The new design is for 44,000 volts as against 22,000 volts, as formerly intended. The doubling of the voltage and the shortening of the transmission line is expected to cut the line loss in four, and the saving in initial erection cost is estimated at \$80,000.

The Las Chispas is one of the large silver producers in northern Mexico. Wood fuel has been almost entirely exhausted in the neighborhood, with the result that the cost of power has become prohibitive. It is expected when electrical power is available an exploration of the additional veins will be undertaken.

Special Order Permits Entry of British Miners for Michigan

Fifty English miners recently passed through the port of Sault Ste. Marie from Canada and went to the Michigan copper district, where they secured employment at the mines. More are expected soon. Early this year the immigration inspector at the port recommended to Washington that 500 miners be permitted to enter from Europe for mines in the copper district of Michigan, which have been short-handed for many months. Despite the fact that the quota for the United Kingdom was filled for the month, the miners were permitted to enter under a special order that was obtained from the government officials at Washington.

Union Minière Will Build Electrolytic Copper Refinery

THE Union Minière, operating the huge copper mines in the Katanga country, Belgian Congo, plans to build a 35,000-ton electrolytic copper plant, according to recent advices received in this country. The plan is being heralded abroad as the first step toward making Europe independent of American electrolytic copper.

Power Shortage Curtails Output on Marquette Range

The Cleveland-Cliffs Iron Co. has been forced to curtail mining operations at its twelve operating mines on the Marquette iron range in Michigan, owing to a shortage of electric current. As a consequence of the lack of rainfall, the storage reservoirs which keep the company's hydro-electric plants supplied with water are very low and little water can be expected to reach the streams at this late season. The mines are working on a five-day week basis at present. The steam turbines have been in operation for the last month, but even with the auxiliary units there is now insufficient power for all needs. It is expected that, when the new storage dam on the Dead River, now under construction, is completed and filled, such a shortage of water will not again arise. To date the rainfall for the year has reached 18 in., whereas the average for the last 40 years in the district has been 32 in.

McIntyre Earned \$100,000 Per Month During Third Quarter

For the three months ending Sept. 30, McIntyre Porcupine Mines reports gross recovery of \$681,000 and costs of \$407,500, leaving an operating profit of \$273,500, and non-operating revenues of \$19,500, giving total profits of \$293,000. Accrued taxes amounted to \$15,500, and net profits, before plant depreciation, were \$277,500. This indicates a substantial increase in gross recovery and net profits. It is understood that the ore now being treated is of higher grade, and there should be a further improvement in the next quarter.

Anaconda and Davis-Daly Will Enter Ring on Jan. 20

After an agreement had been reached on Oct. 8 between counsel for both companies, Federal Judge Bourquin announced that the suit of the Anaconda Copper Mining Co. against the Davis-Daly Copper Co. will begin in the federal court at Butte, Mont., Jan. 20, 1924. The suit has been brought to determine the ownership of valuable ore-bodies. The case brings together some of the best legal and expert geological talent in the country.

A. S. & R. Sells Southeast Missouri Lead Mines to St. Joseph Lead Co.

Price Includes \$10,000,000 and Thirty-year Smelting Contract—
Economies of Operation in Both Mining and Smelting
Promised—St. Joseph Will Sell the Lead

THE St. Joseph Lead Co. has closed a deal whereby it acquires all the mining property of the Federal Lead Co., a subsidiary of the American Smelting & Refining Co., in the Flat River lead district in southeastern Missouri. The mines of the two companies adjoin each other. The A. S. & R. Co. gets for its property \$10,000,000 and a thirty-year smelting contract, calling for two-thirds of the ore taken from all the mines in the district, which include those belonging to the Doe Run Lead Co., a subsidiary of the St. Joseph company. It is believed that the unified control of all the properties will result in important operating economies, and will permit of the mining of lower grade ore which could not be mined profitably under conditions obtaining heretofore.

Payment has been made by check for \$5,000,000 and five notes of \$1,000,000 each, maturing one each year. No bond issue or other financing will be done by St. Joseph Lead in connection with this transaction. The merger makes the St. Joseph company the largest individual miner of lead ores in the world. With its sales contracts covering the selling of the lead output of the Bunker Hill & Sullivan and the Hecla companies, in the Coeur d'Alene district in Idaho, it will, when Hecla is again producing, be selling about half the domestic lead smelted in the United

States. The Federal output in Missouri has been about 3,000 tons a month.

The A. S. & R. Co. will be able to smelt the ores more economically than if the two companies had continued to operate independently as heretofore. By retaining the smelting of one-third the tonnage the St. Joseph Lead company will have sufficient ore to keep its smelter at Herculeum in operation.

As a result of obtaining this thirty-year smelting contract the A. S. & R. Co. will begin immediately to increase the capacity of its lead smelter at Federal, Ill. It will then smelt fully three-quarters of the lead produced in the United States. With its Mexican output it will also remain, despite the loss of the Federal Lead product, the largest seller of lead in the world. Besides its Mexican lead smelters, the company has lead smelters at El Paso, Durango, Leadville, Murray, East Helena and the Selby works, near San Francisco.

Retirement from the mining of southeastern Missouri lead ores and obtaining the smelting contract for many years upon a tonnage that will be more than twice what would have been ultimate tonnage obtained from Federal Co., is in line with the smelting company's policy of doing as little mining of both copper and lead ores as is consistent with obtaining adequate ore supplies for its various smelters.

Cave-in Catches Four in Utah-Apex Mine

Stope Timbers Give Way—Joseph Norden, Superintendent, Has Narrow Escape

A cave-in occurred in a stope on the 1,500 level at the Utah-Apex mine, at Bingham, Utah, near closing time on the afternoon of Tuesday, Oct. 16, causing the death of the foreman, Dan Eden. Three other men, Richard Armstrong, timberman; Charles Carsons, and O. C. Nelson, were also killed. The four bodies have been recovered from the mass of broken rock, dirt, and timber that crashed down on the men.

The stope in which the accident occurred (which was 70x70 ft.) began to take weight on Monday afternoon, and immediately the work of retimbering was begun under the direction of the superintendent, Joseph Norden, and Eden, the foreman. The work was rushed practically all night and through the next day until closing time. A few minutes before the ground gave way, Eden called to the men, who were above him, to halt work for the day. The men, including Norden, started down

a ladder, when the crash came and many tons of dirt and rock came down upon them. Rescuers coming immediately to the scene, after an hour's work reached the body of Foreman Eden wedged in by twisted timbers. Later they released Norden, whose leg was broken, and Rotalaza, who had done good work helping the superintendent. The bodies of the others killed in the cave were found the next day.

Kay Copper Co. Will Ship from Kingman, Ariz.

The Kay Copper Co., operating in Mineral Park, about 25 miles north of Kingman, Ariz., is giving evidence of being a real mine. Recent development upon the 50-ft. (deepest) level shows a crosscut 100 ft. long with nothing but ore in sight. Samples average about 3 per cent copper.

In addition, a richer vein 4 ft. wide has been uncovered. The copper is in form of the black oxide, carrying little or no silver and gold. At another point a 3-ft. vein shows considerable copper glance, the ore averaging about 15 per cent copper.

The lease covering the claims carries a bond of \$60,000, payable in nine months. The company is managed by E. J. Carter, formerly with the Smuggler-Union, of Colorado. A new shaft has been started some 200 ft. from the present workings.

California Rand Silver Finds New Orebody

Milled 8,266 Tons, Shipped 224 in September—Mill Extraction 93.62 Per Cent Silver

The current report of the California Rand Silver, Inc., says that the outstanding recent development in the mine is the discovery of large new milling orebodies on the seventh and eighth levels. On the seventh level, 100 ft. south of the east crosscut on the so-called antimony vein, a drift has been run 150 ft. through a body of ore averaging about 30 oz. in silver and \$2.40 in gold, and the end of the drift is still in ore. This ledge in about 14 ft. wide where raises have been made in it. On the eighth level, in much the same corresponding position, about 50 ft. south of the east crosscut, an orebody running from 35 to 40 oz. in silver and \$2.40 in gold has been followed for nearly 40 ft., the average width of the ore so far exposed being about 20 ft. A gratifying feature of this discovery is the fact that the seventh and eighth levels are 100 ft. apart and there is every reason to expect that the two discoveries will prove to be a continuous body of ore from one level to the other. A drift on the ninth level, which is 70 ft. below the eighth, in approximately the same position, is being opened in the hope of encountering the same shoot.

Shipments for the month included 520 tons of concentrate from 8,266 tons of ore and 224 tons of direct shipping ore. Figuring gold at \$20 and silver at 65c., M. N. Colman, mill superintendent, reported as follows for September operations:

Total ore milled, tons	8,266
Daily average (30 days), tons	275.53
Daily average, running time, tons	407.359
Cause of lost time	
Delays	202 hours 55 minutes
Repairs	30 hours 5 minutes
Time efficiency, per cent	67.64
Average gold heads	\$2.183
Average silver heads	14.653
Total average	\$16.836
Average gold tailing	\$0.568
Average silver tailing	0.934
Total average	\$1.502
Average gold extraction, per cent	74
Average silver extraction, per cent	93.62
Total average per cent	91.1
Recovery per ton	\$15.334
Recovery on 8,266 tons	126,750.844
Average value per ton concentrate	298.05
Tons of concentrates produced	425.26
Tons of concentrate shipped	520

The abnormal amount of lost time was occasioned by breakdowns in the Yellow Aster pumps and pipe line beyond the control of the management to prevent. However, water conditions are now reported as once more normal. Net smelter returns for the month were \$128,143.59.

Spanish Quicksilver Production Declines Since April

Twenty-three Thousand Flasks Produced or Warehoused in First Half of 1923

The following statistics showing sales of quicksilver and stocks on hand from January to July, 1923, as reported by the Board of Directors of the Mines of Almaden and Arrayanes, have been received by the Department of Commerce.

Sales and Stocks of Quicksilver in Spain
In Flasks

1923	Produced or Entered in Warehouses	Withdrawn for Sale	Stock on Hand at End of Month	Value of Sales, Pesetas (b)
January	4,510	8,773	24,594	2,270,603
February	5,591	6,760	23,425	1,794,085
March	5,784	9,065	20,144	2,262,280
April	4,380	7,900	16,624	2,134,244
May	1,570	832	17,362	225,677
June	1,565	440	18,487	129,159
July	185	1,039	17,633	320,442
Totals	23,585	34,809		9,136,490

(a) Each flask contains 34.5 kg. of quicksilver.

(b) 1 peseta equals \$0.193 at normal, or about \$0.14 at the current rate of exchange.

The Consejo de Administracion in a meeting held on Aug. 7 fixed the price of quicksilver at 297 pesetas per flask at mine warehouse, with 3½ per cent off for cash. Buyers of 1,000 or more flasks are to be conceded an additional 6 per cent discount, which is also to be granted Spanish buyers who use quicksilver in their industry, provided they have paid their corresponding industrial or commercial tax and do not export the quicksilver. One peseta per flask is charged for delivering the quicksilver on board cars at Almaden. The prices have fallen considerably since the end of June, when quicksilver was selling at 340 pesetas per flask.

Belgian Congo Mining Prospers, Recent Reports Show

The Forminière, the Belgian Congo company in which the Ryan-Guggenheim Syndicate is interested, recently declared a substantial dividend as a result of its recent success in the recovery of diamonds. Mining in the Belgian Congo prospered during the last year, according to reports just received in this country. Minerals to the aggregate value of \$25,000,000 were marketed. Copper shipments headed the list, the bulk of the metal coming from the mines of the Union Minière du Haut Katanga.

August Mineral Output From Southern Rhodesia

The mineral output of Southern Rhodesia during the month of August was as follows: Gold, 53,256 oz., valued at £232,546; silver, 14,114 oz.; coal, 61,772 tons; chrome ore, 789 tons; copper, 224 tons; asbestos, 2,020 tons; arsenic, 65 tons; mica, 4 tons; diamonds, 30 carats. The number of producers was 188. In July the gold output was 54,383 oz., valued at £244,848.

News from Washington

By PAUL WOOTON
Special Correspondent

Payment of War Minerals Awards Suspended

Total Now Approaches \$8,500,000 Appropriation—Congress Will Be Asked for Money to Liquidate Valid Claims at 100 Per Cent—Disallowances

NO further awards are being made under the War Minerals Relief Act. The balance of moneys at the disposal of the Secretary of the Interior has reached the point at which it is believed best to take stock before proceeding further with the payment of losses.

The War Minerals Relief Act carries with it a special inhibition against exceeding the \$8,500,000 which was appropriated to meet claims under the act. For that reason, Interior Department officials feel that they are not warranted in paying 100 per cent of claims, if there is any doubt as to the appropriation being sufficient. They are precluded by the law from incurring a deficit, so that findings now are being made simply as to the extent of net losses.

Though there has been no formal announcement of the policy change in this particular, it is regarded as probable that findings of net loss will be made in all the pending claims. There is great uncertainty as to what this total will be, because of the action of the Supreme Court of the District of Columbia in indicating that purchase of property is an allowable item under the law. In addition, several of the large claims before the commissioner depend upon the establishment of certain facts. In one important instance, at least, it would seem that the effort to establish fact is about to be successful. All of these angles of the situation will be brought to the attention of Congress. By the time of its convening, findings will have been made as to the net loss on practically every pending claim. It is expected that Congress will give an indication of its desires in the matter. Since a large number of claimants have received 100 per cent of the amount awarded, it is believed that Congress will consider favorably a further appropriation to insure like payments to other claimants, should it be found that the limits of the fund available must be exceeded.

The claimants will contend, it is practically certain, that no payments should have been made until it had been determined if the fund were sufficient to meet 100 per cent of each award, so that everyone would share equally. In that connection, it may be pointed out, however, that the bulk of the awards were made by the predecessors of the present Secretary of the Interior.

The Secretary of the Interior has approved the following findings as to net loss: Parsons, Williams & Thompson, \$2,562.36; H. M. Parsons, \$4,-

742.66; J. D. Peery, \$3,940.84; Philipsburg-Chicago Manganese Syndicate, \$210.12; W. P. Johnson, \$113; H. N. Dale, \$338; Mortimer Savage, \$631.76; E. E. Mitchell, \$211.25.

The Secretary has approved disallowances, as follows: Benbow, Barker & Kingsbury, prospect; J. E. Reece, commercial importance not established; J. W. Gurney, stimulation not established; Milne Reichman, prospect; Noel & Johnson, withdrawn; Ariel Lowden, not within the act; J. B. Lukens, stimulation not established; Max Mining Co., purchase of property; E. G. Caron, stimulation not established; Shiell Prattie, stimulation not established; Cornucopia, promoting; Wood, Huddart & Gunn, no further award; Chroman Mining Co., stimulation not established; Souza, Williams & Carpenter, stimulation not established; Hynes & Mullen, stimulation not established; F. L. Waller, purchase of lease; Lucky 2 Tungsten Co., stimulation not established; W. E. Casson, stimulation not established.

Japanese Mining Engineers at Tokio Uninjured, Bain Hears

A letter just received by H. Foster Bain, the director of the Bureau of Mines, tells of the escape from injury of several prominent Japanese mining engineers who were in Tokio at the time of the earthquake. Those mentioned in the letter are: Dr. Rituro Hirota, Dr. Reiji Kanda, Viscount Tadashira Snouye, M. Otagawa, Baron Furukawa, and Dr. Takuma Dan. Dr. Dan's home apparently escaped damage, as it was mentioned that he was entertaining the American Ambassador and his family, following the disaster.

Dr. Dan is well known in this country. He was educated at the Massachusetts Institute of Technology and is one of the partners in Mitsui & Co. He developed the Manda coal mine, in southern Japan. In the development of this mine the most modern mechanical equipment has been used. Owing to the large amount of water which had to be handled, Dr. Dan designed special pumps for it. When the designs were received by the pump manufacturers, they held up work on the order until they could cable to make sure that the decimal points were in the right places. As the pumps were the largest ever manufactured at that time, the manufacturers feared that someone had slipped a decimal point. Incidentally these pumps, after many years, still are being operated efficiently and satisfactorily.

Helium Bill Involving \$5,000,000 Will Be Considered

Technique of Manufacture Advances—
Large Experimental Plant at Fort Worth Completed

Steps are being taken to insure the early consideration at the forthcoming session of Congress of the bill which proposes the appropriation of \$5,000,000 for the production of helium. The bill authorizes the Secretary of the Interior to purchase gas containing helium and to acquire extraction rights in gases as well as to lease and purchase lands in helium-bearing gas fields. The measure further proposes that the Secretary of the Interior be authorized to undertake exploration work on such lands and to carry on experimental activities relative to the production and use of helium. The export of the gas could be undertaken only on permission of President of the United States, on account of the scarcity of the gas and its unique value for aeronautics.

The plant on a semi-commercial scale which just has been completed by the Bureau of Mines at Fort Worth is expected to demonstrate in the near future whether or not the promising results in the laboratory can be duplicated on a large scale. The study of the gas now has reached the point where important economies can be effected in its manufacture, it is believed. The situation is entirely different than that at the time the earlier plants were constructed. At that time few data were available. These plants were started on good guesses and liquid air data in an effort to meet a war emergency. Now the research is well advanced, and much more is known of the mechanical equipment necessary to secure the best results.

Southern Clays Equal Imported Product, Bureau Finds

The investigation of the availability of certain minerals for use as fillers, together with a study of their physical and chemical characteristics and their adaptability to commercial uses, is being conducted by the U. S. Bureau of Mines. The South has extensive deposits of clays, ochres, bauxite, talc, and graphite, and the purpose of this study is to determine their value for use as fillers in making linoleum, paper and other commercial products.

The laboratory study of the size and character of grains of non-metallic mineral fillers has been completed. The results show that these characteristics have an important bearing on the applicability of a mineral filler and the types of manufactured products in which it can be used.

Laboratory work on Georgia and Alabama white clays to determine their value for filler use has been completed. The samples investigated included thirty-one Georgia and eleven Alabama clays. Of the Georgia clays, seventeen were selected for more extended semi-commercial tests, and 500 lb. samples were sent to the Ceramic Experiment

Station at Columbus, Ohio, for washing, pulverizing, and dispatching to the manufacturers who are co-operating in the factory tests. The laboratory tests have shown that a number of the Georgia clays tested are equal or superior in quality to the imported foreign clays now largely used in the paper trade.

Advisory Commission on Reclamation Works Behind Closed Doors

Secretary Work's special advisers on reclamation conducted hearings throughout last week after having met on Monday for organization purposes. Thomas E. Campbell, former Governor of Arizona, was selected as chairman of the committee. Dr. John A. Widtsoe, formerly president of the University of Utah, was selected to act as secretary. The other members of the committee, all of whom were present, are: Oscar E. Bradfute, president, American Farm Bureau Federation; James R. Garfield, former Secretary of the Interior, and Clyde C. Dawson, of the Chamber of Commerce of the United States.

The sessions of the special advisers are behind closed doors. Little information is being given out as to developments in the committee room. Such reports as are made on the sessions are colorless and give little indication as to the significant points which the advisers are attempting to develop.

Revise Method of Obtaining Metal Import Statistics

Wait for Official Assays Involved Inaccuracies as Well as Delay—
Commerce Department Acts

In order that the statistics of the Department of Commerce may reflect accurately the importations of metals in ores in the month in which the importation is made, the Treasury Department has amended its regulations so as to provide that quantities and values of metals contained in ores shall be ascertained and reported immediately from the commercial assay shown on the consular invoice or estimated from previous importations, instead of waiting for the official assay.

Heretofore, quantities and values of metals in imported ores have been forwarded the Customs Statistics Section of the Department of Commerce after the ores have been officially assayed and the correct quantities and values determined. The Department of Commerce called attention to the fact that under this system the published statistics are inaccurate and misleading in that they do not represent importations during the month covered by the report.

Under the new ruling, changes in entered quantities and values ascertained from the official assay will be reported so that in final reports of the Customs Statistics Section corrections in the invoice figures or estimates may be made.

News from Mining Districts

By Special Correspondents in the Field

London Letter

Paris Nervous Regarding Rio Tinto—
No Increase in Dividend Rate
—Tin Booms

BY W. A. DOMAN

London, Oct. 11—It had been hoped that the Rio Tinto company would improve upon the interim dividend declaration of last year, and as it did not do so, the amount of 10s. per share being the same, the Paris public has had a nervous fit, and has started a bout of selling. To some extent political events in Spain may have actuated the directors in a policy of caution.

I have frequently referred to Sir Abe Bailey and his mining deals. Mainly his efforts have of late been confined to the Rhodesian market and to precious metal mining. He has now gone into tin. This presumably is purely a share deal, as Cornwall, the scene of his latest activities, is at home and, so to say, very much on the spot. Bailey is a bold speculator and is very good at helping a company in difficulties. But there is a business end to philanthropy. The Geevor Tin Mines, when reconstructed, was not fully supported by shareholders, and in consequence there was a goodly proportion of forfeited shares for disposal. Bailey is reported to have taken 10,000 of such shares, at a price not publicly

stated. His action, however, has given the company a fair amount of working capital. From Rhodesia to Cornwall is a far cry, and it is said that the link between the two is B. H. Nicholson, who has business connections with both the Oliver Wethered and Bailey groups.

I understand that Carl Davis, the consulting engineer to the Anglo-American Corporation group of companies, is in Rhodesia examining properties on behalf of his corporation. This is another big group that has entered the country to search for minerals since the decision to give Rhodesia responsible government.

The rise in the price of tin is bringing into prominence various companies which mine for the metal. I am informed that shares in a small property in Bolivia that has been producing high-grade concentrates for some time and which has paid dividends, but which is not known yet on the London market, are to be introduced here. What is known as the Meyerstein group is to undertake the introduction.

The East Pool and Agar mine (Cornwall) is opening up at the 1,227 level a substantial body of ore carrying high values. So far a width of 14 ft. has been exposed, and the average content is 39 lb. black tin and 103 lb. arsenic per ton. At present prices of tin and arsenic, this body of ore will pay well.

Granby Makes Pig Iron From Copper-furnace Slag

H. S. MUNROE, manager of the Granby Consolidated company, in British Columbia, announces that the technical staff of the company has succeeded in making pig iron from the copper blast-furnace slag in a small reverberatory. It is hoped later to repeat the operation on a commercial scale and at reasonable cost. The furnaces produce about 400 tons of slag, averaging 52 per cent in iron, daily. If the experiments now being conducted culminate successfully, between 60,000 and 70,000 tons of pig iron can be added to Granby's yearly output of metals. Many unsuccessful attempts have been made to develop a process that would do such work profitably.

QUEENSLAND

Railway Will Reopen Jordan Creek Field

A new railway extension just authorized by the Queensland Parliament from the northern port of Innisfail—primarily to open up some fertile country—will encourage further prospecting of an old gold field known as the Jordan Creek field. In the old days good gold prospects were found here, but the country was covered by dense tropical scrub.

In this connection it is interesting to recall that about thirty years ago, rubies as well as gold were found in the Jordan Creek region, and that this is the only place in Queensland where these gems are known to occur. Chief Geologist B. Dunstan says that a mines inspector brought from this field some samples of the minerals occurring in the alluvial wash, and that amongst these were rubies, which had not been previously discovered. A one-carat specimen, on being cut, was found to be a beautiful gem, and worth £20. By this time the field had been abandoned, but the lapidary who cut the stone thought that where that came from there should be others, and Geologist Dunstan, in support of the proposed new railroad, said that other gems may be found in the same neighborhood of immense value.

Motor Lorry Displaces Teams

Latest particulars from the cobalt mine in the Cloncurry district are that the small five-stamp mill erected there as a temporary expedient crushed about 400 tons of ore, and was then dismantled. Two new ball mills are in course of erection, and will soon be ready for use. The hand jig at first installed is still in operation, and contributes a regular quota of concentrates to each month's supply. A motor lorry, which has taken the place of the more slowly moving teams which were once the means of transport, now delivers four tons of ore daily to the railway, 20 miles away.

MEXICO

Special Correspondence from Durango

Open Property in Pueblo Nuevo District

Announcement is made of the formation of the Compañia Minera Asuncion, S. A., headed by General Amado Aguirre, Secretary of Communications and Public Works, with Efren Aguirre, of Durango, as technical director, to work some promising properties in the Pueblo Nuevo district. Pueblo Nuevo is principally a gold district.

Rich Lead-Silver Ore Found

The Compañia Minera Canutillo, R. S. B. Washington, manager, and financed by capitalists from Tampico, has found a lens of lead-silver ore at a depth of 75 ft., assaying 25 per cent lead and 700 gm. silver. This lens of ore appears to be extensive, and a number of additional holes will be put down to prove up its size and thickness. The mine is in the Chalhuites district.

Flotation Plant for Avino

The Avino Mines Co., whose properties are near San Gabriel, has been reorganized, and starts off with new capital with the intention of putting in a flotation plant. Dr. Heberlein, formerly with the Minerale y Metales, is said to be interested in the new company, and there is every reason to believe that the adoption of the flotation process for the Avino ores will prove the solution of that company's troubles. The new move is looked on favorably by those familiar with the ores and the Avino camp.

Reorganization of San Andres

The San Andres de la Sierra Co., controlling over 1,500 acres of mineral land, and which was one of the greatest producers in Durango of recent times, has been reorganized by the creditors of the old company. Back taxes have been paid, and the new management intends to clean out the old workings, and prepare for production. A year or more ago another company, called the Smelter of San Andres de la Sierra, headed by George Stinson, with Torreon capital, built a 25-ton smelter at the site of the old workings and has been operating on custom ores. It is understood that there is no connection between the two companies and that the new company merely intends to preserve the properties and put them on a productive basis. Nevertheless, it would seem that the two companies should reach a mutual understanding, since their operations are closely allied. San Andres de la Sierra in the late 90's was in bonanza and was producing millions of pesos in silver. Some of the finest residences and business blocks in the City of Durango were built from the product of San Andres.

Outlook Improves

In general the mining industry in the Durango district is picking up. Many small operations are under way, several small properties have changed hands, and other old properties that

This Should Make a Prospector's Mouth Water

FROM reports it would appear that the Lincoln Hill mine, at Lower Rochester, Nev., owned by the Great Western Mining Co., is pretty nearly what every miner and mining "man" has dreamed of owning some day. Production in tons is small, but the ore is high-grade. It is said that the two-stamp amalgamating plant is capable of handling only five tons of ore per day, but that average daily clean-ups amount to around \$500. An oreshoot 235 ft. long has been developed by drifting on the tunnel level and raises are now being driven to determine the upward extent of the oreshoot. Since last June this property has produced go'd valued at about \$80,000.

have been shut down for a number of years waiting for better times are said to be preparing for reorganization, or, in case new capital is not required urgently, to begin operations on a small scale. Agricultural crops are excellent this year, and that always means more activity in mining, because cheap food is of material assistance to the mining industry.

BURMA

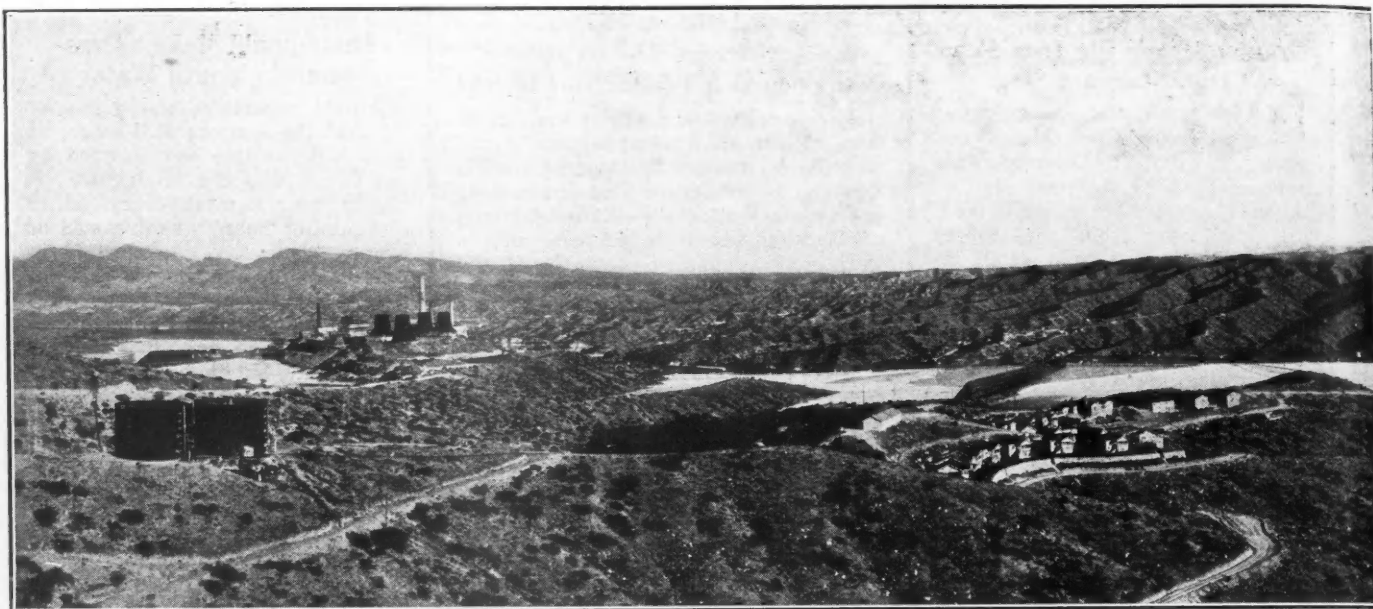
Burma Corporation Mined 660 Tons Per Day in September

The Burma Corporation during the month of September mined 19,974 tons of ore at Bawdwin; 21,620 tons of ore was milled in the treatment plant at Namtu, producing 11,058 tons of lead concentrate; 10,381 tons of lead-bearing material was smelted in the blast furnaces, producing 4,086 tons of hard lead for treatment in the refinery. Refinery products were 3,834 tons of refined lead, and 435,185 oz. of refined silver. The tonnage milled includes re-treatment of 2,052 tons of accumulated tailing.

Of silver production 21,000 oz. was recovered from the treatment of copper matte. The experimental zinc plant produced 1,218 tons of zinc concentrate, assaying 10 oz. silver, 7.2 per cent lead, and 48 per cent zinc. In addition to the above-noted production, 200 tons of antimonial lead was sold and shipped, and 220 tons of copper matte produced ready for shipment from the treatment of a considerable quantity of accumulated smelter byproducts.

Chichagof Leases Mine

The Chichagof Mining Co., Chichagof Island, Alaska, controlled by W. R. Rust, of Tacoma, and his associates, has discontinued company operations and has leased its ground. The mine has made an excellent record and has been steadily operated for a period of years. The ore is free milling gold quartz which was amalgamated at the mine.



International smelter

Miami tailing pond

Miami, shown here, with Globe, five miles away,

BRITISH COLUMBIA

Will Develop Gibson Mine

The Gibson mine is to be further developed by the Daybreak Mining Co., which succeeds the Gibson Mining Co. J. C. Roberts, president of the former company, and Robert Gunning, of Portland, Ore., who holds a large block of shares in the company, recently visited the property. A contract is being let for the driving of 1,000 ft. of tunnel and bunk houses are being built for the housing of the workmen.

Good Report on Fish Creek

The American Mining & Milling Co. is reported to have had a favorable report from its consulting engineer, Andrew Larsen, with respect to the results of development work on its properties on Fish Creek and in other parts of the Portland Canal district. Grant Mahood is being succeeded as president by Major W. G. Swan. The International Financiers, Ltd., a new company, has been formed by Mr. Mahood and is said to have unwritten the entire treasury stock of the parent company. The American company has options on some Georgia River properties, in the Portland Canal district, and is acquiring control of others in that locality.

Outsider Mine Equipped

The Granby Consolidated Mining, Smelting & Power Co. has practically completed the equipping of the Outsider mine, at Maple Bay, on the Portland Canal, and shipping to Anyox will be started within the next few days. In an air line the mine is only 7 miles from Anyox, but the ore has to be shipped between 50 and 60 miles by water. The ore is highly siliceous and is desirable as a flux for the Hidden Creek ores. The large new dam at Anyox is practically finished and will be put into service soon. This work has

been delayed by the fire which took place in the summer; the latter also will delay the completion of the new concentrator, which now is scheduled to be started in February, instead of at the first of the new year.

ONTARIO

Prospecting at Porcupine Continues

Diamond drilling on the Porcupine Grande property, in the Porcupine district, is reported to have met with satisfactory results. Officers state that the first hole gave one section assaying \$44 over 7½ ft., another section, showing 10 ft., assaying \$11. The shaft of the Paymaster has reached a depth of 600 ft., and will be continued to 1,000 ft. The property, which is controlled by Boston people, has been actively developed for the last two years. The annual report of the Golddale states that results to date fully justify the work and expenditures, having definitely determined the existence of ore in commercial quantities on the 500 level. The shaft has now reached a depth of 1,000 ft., and crosscutting from this point has been started.

Wright-Hargreaves Has Shoot West of Fault

On the 550 level of the Wright-Hargreaves mine, in Kirkland, an oreshoot has been opened up west of the main fault. This oreshoot, which is the first commercial ore found west of the fault, has been proved for a length of 250 ft., and shows commercial values for a width of approximately 40 ft. It will now be opened up on other levels. At the 750 level of the neighboring Sylvanite, which is controlled by the Wright-Hargreaves, a short crosscut from the shaft has intersected the best ore yet found on the property. Shaft sinking has again been started, and the next level will be at 875 ft.

NEVADA

Tonopah Shipments Increase

Bullion shipments from Tonopah indicate a production of about \$300,000 during September. The Tonopah Extension shipped \$145,000, the West End \$82,000, the Belmont \$38,000 and the Tonopah Mining Co. about \$50,000. This is larger than August shipments, but this is partly due to the shipment by the Tonopah Belmont Development Co., which company made no shipment in August.

Belmont Finds New Ore

The Tonopah Belmont has discovered a new body of ore of good grade in the South vein and is developing it on both the 900 and 1,000 levels. The Belmont is producing about 100 tons of ore per day, shipping to the Tonopah Mining Co. plant at Millers. The Tonopah Extension is also having good success in development on the lower levels.

Mayflower Will Be Developed

The Mayflower group of claims in the eastern portion of the Goldfield mining district has been purchased by a group of Reno men, formerly of Goldfield, and work is to be started at once. This ground is near that now being worked by the Silver Pick Consolidated, but is really in a portion of the district that has been little developed. Fair assays can be obtained on the surface, but no ore of commercial extent has been found.

ARIZONA

Crown King Buys Claims

The Crown King Consolidated Mines Co., whose property is in northern Arizona near Prescott, recently secured thirty-one patented and twenty-eight unpatented claims in the Tiger and Pine Grove districts for a consideration of \$40,000.



Miami tailing Pond Miami concentrator Town of Miami Result of subsidence
Main Miami shaft

forms the greatest copper-producing district in Arizona

WASHINGTON

Santa Rita Produces Steadily

The Santa Rita mine, 18 miles West of Springdale, in Stevens County, is steadily producing concentrates. The mine, which has been idle for many years, resumed development two years ago, and a mill was built on the property. Seven tons of concentrate is being produced daily and hauled by truck to the railroad at Springdale. Mill equipment includes crusher, rolls, ball mill, sand pumps, flotation tables, thickener, and drier. The ore is from a body 150 ft. long and 30 ft. wide carrying 10 per cent lead. The concentrates carry 15 oz. silver and 50 per cent lead.

Iron Creek Increases Shipments

Another truck will be put into service and shipments increased from the property of the Iron Creek Mining Co., near Keller, according to James Angle, manager. Shipping ore has been found on the new winze level, in a shoot 4 ft. wide; assays show 6.4 per cent lead and 61.6 oz. of silver.

UTAH

American Star Ships from Eureka

In the American Star mine, which is being operated through the adjoining Eagle & Blue Bell, under the same management, ore has been found 150 ft. further to the south than the strike made some time ago; the grade of the ore is higher. A car of ore has been shipped from the property.

Iron Blossom Pays Dividend

The Iron Blossom Mining Co., of Eureka, has announced a dividend of 2½c. a share, or \$25,000, payable Oct. 25. This payment—No. 54—brings the total by the company to \$3,475,000. The Iron Blossom is keeping up its output and doing extensive development.

MICHIGAN

Franklin Cuts Kearsarge Lode

In the Michigan copper district, Franklin's new shaft, which is being sunk to investigate the Kearsarge lode, has encountered the lode at a depth of 50 ft. This is considered a highly encouraging development, for it bears out the theory that the vein would be cut at this point. Progress from now on should be more rapid, for the miners will not have to contend with water and sand which have slowed up operations for some time. Developments from this point on will be important, for interest will be centered on whether there are copper values in the formation. Identification of the rock will not be possible until greater depth is reached.

Mayflower Searches for Lode

Mayflower, which has been in commercial ground for a considerable stretch, has temporarily lost the vein through faulting, faults being encountered almost simultaneously on the 1,400 and 1,700 levels. Short crosscuts are now being run to the east and west to again pick up the formation. Inasmuch as the ground has been more regular of late it is believed the lode will soon be cut.

JOPLIN-MIAMI DISTRICT

New Concentrators Start

Several new mills have been placed in operation recently, taking the place of a number that have been voluntarily shut down in the curtailment program. The Indiana L. & Z. Co., whose mill was lost by fire early in the year, has completed one to take its place and started it in operation. The Federal Mining & Smelting Co. has started its new Kansas mill, in the Kansas field. The Tulsa-Quapaw mill, the largest in the Kansas field, also is being operated now. The Quapaw Mining Corporation will

have the Wolverine mill, west of Quapaw, ready for operation in the near future. The Chanute Spelter Co. has started its Ebenstein mill once more and may start the Hartley. N. J. Andrew has started a new mill southwest of Baxter, built by him for Indiana investors.

MINNESOTA

Oliver Improves Plant at Soudan Mine

The Oliver Iron Mining Co. has started many improvements at its Soudan mine, near Tower, on the Vermilion range. The improvements underground include the relining of the No. 8 shaft from surface to the 1,000 level. The present method of hoisting in mine ore cars will be discontinued and hereafter all ore will be hoisted to the surface in skips. The work of sinking the shaft an additional 200 ft. has been completed, which gives a total depth of 2,089 ft. On surface the old timber headframe will be replaced by a steel one, while many modern improvements will be made in the crushing house. The system of hauling the ore to the crushing house with mules will be abandoned and electrically driven cars will be used instead. The same company is just completing steel cantilever extensions on its stockpile trestle at the Pioneer mine, near Ely.

Five-Day Week for Mine Operation

A new system of hours for underground work has been initiated by the Oliver Iron Mining Co. at its mines on the Vermilion range. It calls for a shift of nine hours a day and work for only five days a week. The night shift on Saturday night has been discontinued. Although only five shifts are worked per week, the men are paid on a basis of six shifts per week. This system has been in operation at some of the company's properties on the Menominee and Gogebic ranges for some time.

THE MARKET REPORT

Daily Prices of Metals

Oct.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
18	12.625	41.375	41.875	6.85	6.55	6.375
19	12.625	41.125	41.50	6.85	6.55	6.30@6.40
20	12.50@12.625	41.00	41.375	6.85	6.55	6.30@6.40
22	12.55	40.50	41.00	6.85	6.55	6.30@6.35
23	12.375@12.50	40.625	41.125	6.85	6.55	6.30
24	12.375	41.125	41.75	6.85	6.55	6.275
Av.	12.529	41.958	41.438	6.85	6.55	6.329

*These prices correspond to the following quotations for copper delivered: Oct. 18th and 19th, 12.875c.; 20th, 12.75@12.875c.; 22d, 12.80c.; 23d, 12.625@12.75c.; 24th, 12.625c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Oct.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
18	61	61 ^{1/2}	64 ^{1/4}	204	201 ^{7/8}	27 ^{3/4}	26 ^{1/2}	33 ^{3/4}	32 ^{3/4}
19	60 ^{3/4}	61 ^{1/2}	64	204	201 ^{3/4}	27 ^{1/2}	26 ^{3/4}	33 ^{3/4}	32 ^{3/4}
22	60 ^{3/4}	61	63 ^{3/4}	201 ^{3/4}	200	28	26 ^{3/4}	33 ^{3/4}	32 ^{3/4}
23	60 ^{1/2}	60 ^{7/8}	63 ^{3/4}	202 ^{1/2}	200 ^{1/4}	28 ^{3/4}	27	33 ^{3/4}	32 ^{1/2}
24	59 ^{3/4}	60 ^{3/8}	63 ^{1/2}	204 ^{1/2}	202	28 ^{3/4}	26 ^{3/4}	33 ^{1/2}	32 ^{1/2}

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver			Oct.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London	Gold London			New York	London	
18	4.52 ^{1/2}	63 ^{1/2}	31 ^{3/8}	91s 4d	22	4.49	63 ^{3/8}	32 ^{3/8}	91s 9d
19	4.52 ^{1/2}	63 ^{3/8}	31 ^{3/8}	91s 4d	23	4.47 ^{3/8}	63 ^{3/8}	31 ^{3/8}	92s 3d
20	4.50 ^{3/8}	63 ^{3/8}	31 ^{3/8}	24	4.49 ^{3/8}	63 ^{3/8}	31 ^{3/8}	91s 11d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, Oct. 24, 1923

The metal markets have not been active during the last week, except that of tin. Sales of copper and zinc have been particularly light, both here and abroad, and prices have decreased. Lead continues in fair demand at unchanged prices.

Copper

Domestic consumers continue to refrain from buying in any important quantity. An occasional sale of as much as 500 tons has been made, but

certainly the total quantity sold has not equaled production by a considerable amount. Most producers are nominally asking prices about one-quarter cent above that at which the greater part of the actual business has been placed, rightly feeling that to reduce prices to the point where any considerable tonnage would be sold would have a disastrous effect on the market. No further cuts in production have been heralded lately, but it seems probable that the time must come when some of the higher-cost producers must curtail or close down, as expansion seems to

be in order for the large low-cost producers, and consumption in the next year is expected by many to be less than it has been in the last year. The foreign situation is as bad as ever, and no prospect of an early improvement in European consumption can be seen.

Sellers of copper with an eye on the international market have weakened with the almost daily decline in London, until today copper could be obtained at 12^{3/4}c. delivered, in several quarters. Foreign sales have not been so good as last week, doubtless due in large measure to the political news from Germany, though some business has been placed in Japan and France.

Copper for delivery in the first quarter of 1924 is obtainable at the same prices as quoted for near-by metal.

Lead

The official contract price of the American Smelting & Refining Co. continues at 6.85c., New York. This price is also generally quoted by all other sellers for November shipment, even by Middle Western producers, who are now in active competition for the eastern business, which nets them about the same as sales in their own territory. Spot lead still commands a slight premium, some having been sold for 6.90c., but in insignificant tonnage. In St. Louis, quotations range from 6.55c. to 6.60c., with practically all of the business being done at the lower level. On the whole, sales have not been particularly large during the week, but some good orders will soon be placed, and there is no pressure to sell.

An excellent market for lead continues abroad, owing principally to the limited supply rather than to excessive demand. If the foreign demand continues on the present scale, it may absorb all the lead smelted here from Mexican ores, as well as the Mexican bullion which has been sold abroad for some time. The backwardation in London is of interest, the price of spot lead being £2 above that for forward. A "squeeze" is indicated, made possible by short supplies.

The chief news in the lead market broke this morning, on the announcement that the St. Joseph Lead Co. had bought the mines and concentrators of the Federal Lead Co. and would hereafter sell the greater part of the chemical lead heretofore marketed by the American Smelting & Refining Co. This will make the total volume of lead sold by St. Joe almost equal to that handled by the A. S. & R., which includes a large Mexican production. Further particulars are given on pages 736 and 744.

Zinc

Producers have not had an easy time selling slab zinc during the week. No active market seemed to exist. Consequently, prices have shown a tendency to decline, so that the metal was sold today for 6.25c. per lb., East St. Louis, compared with 6.35c. a week ago. Nevertheless, the weakness in the zinc market is more apparent than real. Although export business has momentarily ceased, it is expected to be placed again before long. Some of the domestic sales made last week have the appearance of having been forced to realize cash quickly. The Joplin ore miners are showing an inclination to curtail production in sympathy with the weaker metal market, which should help matters materially. The demand for high-grade zinc is keeping up satisfactorily, and sales have been made at prices unchanged from last week, 8 to 8½c. per lb.

Tin

The tin market has been quite active, with a fair sprinkling of orders from consumers. Spot metal is particularly scarce, but several thousand tons are expected in within a week, which will no doubt result in a plethora of the metal. Forward tin has sold for about one-quarter cent discount from the price of spot. Arrivals of tin, in long tons: Oct. 18th, Straits, 25; 22d, Liverpool, 300; Straits, 50; total so far in October, 3,145.

Silver

Indian bazaar orders have been the main strength of the market—in fact, bear covering from this quarter forced the London market up to 32½d. on the 22d. New York did not advance so sharply on that date, but local prices have continued to improve in spite of the reaction in London. The market closes steady.

Mexican Dollars—Oct. 18th, 48½; 19th, 48¾; 20th, 48¾; 22d, 48¾; 23d, 48½; 24th, 48¾.

Foreign Exchange

Disturbed political conditions had a bad effect on European exchanges in the last week, sterling, for example, selling at a new low for the year. On Tuesday, Oct. 23, cable quotations on francs were 5.85c., and lire, 4.46c. Canadian dollars 1¼ per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 26@27c. per lb.; 93 per cent, 25@26c. London, £115 per long ton.

Antimony—Chinese and Japanese brands 8@8½c. W.C.C. brand, 8½@9c. Cookson's "C" grade, 10.50c.

Market very strong. Political troubles in China affecting supply.

Bismuth—\$2.55 per lb. London, 10s.

Cadmium—80c. per lb. London, 3s.

Cobalt—\$3 per lb. for spot.

Iridium—\$275@£300 per oz.

Nickel—27@32c. per lb. for 99 per cent virgin metal. London, £125@£130 long ton.

Palladium—\$80 per oz.

Platinum—\$116 per oz. London, £24 15s.@£25.

Quicksilver—\$62 per 75-lb. flask. Quiet. San Francisco wires \$61. London, £9 5s.

The prices of **Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Selenium, Tellurium, Thallium, and Tungsten** are unchanged from prices given Oct. 6.

Metallic Ores

Tungsten Ore—High-grade wolframite, \$8.50@£9; high-grade scheelite, \$9@£9.50 per unit. Ordinary grades, \$8@£8.50.

Chrome, Iron Ore, Magnetite, Manganese, Molybdenum, Titanium, Vanadium, and Zircon Ore are unchanged from the quotations published Oct. 6.

Zinc and Lead Ore Markets

Joplin, Mo., Oct. 20—Zinc blende, per ton, high, \$41.60; basis 60 per cent zinc, premium, \$40; Prime Western, \$39; fines and slimes, \$38@£36; average settling price, all zinc ores, \$39.61.

Lead ore, high, \$86; basis 80 per cent lead, \$83@£80; average settling price, all lead ore, \$84.01 per ton.

Shipments for the week: Blende, 9,272; lead, 934 tons. Value, all ores the week, \$445,740.

One seller claimed to sell Prime Western on \$39.50 basis, for blende, but declined to name the buyer, and no confirmation could be made. Lower offerings for lead, together with last week's partial closing of the mines, reduced the shipment to a pronounced degree. The Falcon company's zinc smelter at Fort Smith was on dead fire during the week owing to the flood waters of the Canadian and Cimarron rivers, which swelled the Arkansas near its plant and shut off the city water supply, upon which dependance for water is placed.

Platteville, Wis., Oct. 20—Blende, basis 60 per cent zinc, \$42 per ton. Lead, basis 80 per cent lead, \$86 per ton. Shipments for the week: Blende, 790 tons; lead, 45 tons. Shipments for the year: Blende, 26,116; lead, 650 tons. Shipments for the week to separating plants, 862 tons blende.

Non-Metallic Minerals

Asbestos—Crude No. 1, \$350@£500; No. 2, \$250@£300; spinning fibers, \$125@£150; magnesia and compressed sheet fibers, \$75@£110; shingle stock, \$50@£65; paper stock, \$30@£40; cement stock, \$17@£20; floats, \$8@£12. All f.o.b. mines, per short ton, Quebec.

Barytes, Bauxite, Beryl, Borax, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Graphite, Gypsum, Limestone, Magnesite, Manjak, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, Sulphur, Talc and Tripoli are unchanged from the Oct. 6 prices.

Mineral Products

Arsenious Oxide (white arsenic)—12c. per lb.

Copper Sulphate—4.90@5c. per lb., domestic product.

Potassium Sulphate, Sodium Nitrate, and Sodium Sulphate are unchanged from quotations of Oct. 6.

Ferro-Alloys

Ferromanganese—Domestic, 78@82 per cent, generally obtainable at \$110 per gross ton, f.o.b. works. Spiegeleisen, 19@21 per cent, \$45; 16@19 per cent, \$44.

Ferrosilicon—50 per cent, \$85.

Ferrotungsten—88@90c. per lb. of contained W, f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrotitanium, Ferrouranium and Ferrovandium are unchanged from the prices published Oct. 6.

Metal Products

Copper—Sheets, 20½c. base; wire, 15½c.

Lead Sheets—Cut, 10.50c.; full, 10.25c. per lb.

Nickel Silver—18 per cent Grade A sheets, 27½c.

Yellow Metal—Dimension sheets, 18½c.; rods, 15½c.

Zinc Sheets—Base price, \$9.25 per 100 lb., f.o.b. plant.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick and Zirkite are unchanged from the Oct. 6 prices.

The Iron Trade**Pittsburgh, Oct. 23, 1923**

The steel market continues to give a much better account of itself than was expected. The steel mills are not running chiefly on momentum, as they were a few months ago, shipments being chiefly against recent orders. The present outlook is that mill operations will decrease but little before December at the earliest, and that prices in general will be maintained through the year.

Demand is best in tin plate, merchant pipe, sheets and wire products. It is relatively poor in plates, shapes, and bars. Rails have sold freely for the first half of the new year and there are fair rollings for the remainder of this year.

Pig Iron—The market is quieter still, quite out of harmony with consumption, which cannot have decreased a great deal. Bessemer is off 50c. to \$25, Valley, while basic, foundry and malleable remain at \$24, Valley.

Connellsville Coke—Decreased production is helping to steady the market. The minimum on heating coke is up 25c. to \$3.25. Furnace remains at \$3.75@£4 and foundry at \$5@£5.50.

Lead Market Is Exceptional

Compared With Copper or Zinc the Metal Is in a Much Better Position

By Felix Edgar Wormser

Assistant Editor

OF LATE the statement has been made occasionally that prices of the non-ferrous metals are far from satisfactory and are subjecting producers to unprofitable operations. Such a sweeping statement needs an important qualification, for, although for some producers, it may be true of copper, zinc, silver, and tin (which is not produced in the United States), it is hardly a proper characterization for the price of lead. At 6.85c. per lb. in New York, lead-mining and lead-smelting companies are obtaining a fair return for the metal and one at which they should be able to show satisfactory financial results. Producers generally are not complaining about the present market.

Lead is in an excellent statistical position. It is interesting to make a comparison of the lead and copper situation, as it brings out the underlying reason for the continued unusually high price of lead and the continued abnormally low price of copper. There are several explanations for this peculiar circumstance. In the first place, the world's lead production did not show a great jump during the war and after. Furthermore, the lead market was not plagued with exceedingly heavy stocks of surplus and second-hand metal after the armistice. Then again, the lead market is protected by a 2½c. tariff. Another reason is that lead is insistently called for by European countries, whereas copper is not so much in demand as it should be.

The following figures, in round numbers, indicate the great increase in copper production during the war compared with the much smaller relative increase in lead production. An increase in productive capacity, it is to be remembered, generally demands a corresponding increase in capital outlay, an expense to which the lead mining industry was not put.

World's Lead and Copper Production 1913-1923

(In thousands of short tons)

Year	World's Lead Production (a)	World's Copper Production (a)
1913	1,292	1,073
1914	1,273	1,012
1915	1,220	1,188
1916	1,255	1,553
1917	1,290	1,580
1918	1,318	1,570
1919	976	1,069
1920	949	1,078
1921	957	591
1922	1,149	988

Lead producers for the last two years have been able to benefit by the flourishing condition of two great American industries—the building boom and automobile manufacture. The building trades use large amounts of lead in paints and pipe, and every new automobile has a storage battery with lead plates. Incidentally, the storage-battery business received a strong impetus from the demand for radio apparatus. Lead enters into the composition of so many useful articles from such minor uses, as in the small weights inserted in the lining of women's garments and the wrapping of chewing gum to the manufacture of ammunition, that the market has at all times an exceptionally diversified consumption, which is much in its favor. Compare this with the situation in zinc and the contrast is striking. Zinc producers are chiefly dependent upon two outlets for their production, the galvanizing industry and the brass and alloy manufacturers. When these two branches refrain from buying the market is severely depressed.

Stocks of lead in the United States are small and practically negligible as a market element. Domestic production is at the rate of about 38,000 tons of pig lead per month. American consumption is taking all of it.

Before the war the principal lead producing countries had the following productive relation. Their position last year is also shown:

World's Lead Production in 1913 and 1922

(In short tons)

	1913	1922
United States	435,700	483,000
Spain	219,100	120,000
Germany	207,200	79,000
Australia	126,200	115,000
Mexico	68,300	132,000
World	1,292,000	1,149,000

Although American and particularly Mexican production shows an increase, Spanish, German, and Australian output are smaller than the pre-war rate. Mexican production has been affected by the strike of miners at Chihuahua, but is proceeding at about 15,000 tons per month. Mexican pig lead always seeks the best market and much of it is shuttled to either Europe or the United States, depending upon which destination has the most attractive price. This condition applies especially to the Mexican lead that can be conveniently shipped to a local seaport and from there by water to London or New York. Mexican lead serves the important function of helping to keep both markets relatively close together, making allowances for tariff, exchange, and shipping charges. Owing to the strong demand for lead in Europe, most Mexican lead has been directed abroad.

Mexican lead in ores and concentrates carries a lower rate of duty when imported into the United States, and its release for American consumption occupies a different status.

Europe has long been accustomed to use supplies of lead from Spain. At present the entire Spanish output is estimated to be not over 7,000 tons per month, compared with 18,000 tons in pre-war days. The decline is caused by labor troubles, although some well-informed persons in the trade feel that the tenor of Spanish lead ores has decreased seriously. It is reported that some of the production is being used by Spanish paint manufacturers. Regardless of the reason for the drop in Spanish production, its effect can only be interpreted as favorable for the American producers.

Buying of lead may occur in waves of varying duration. The present one began in July and has not spent its force. Prices rose as buying continued, and it is to be noted that the St. Louis market advanced more rapidly than that in New York, so that they were brought close together for a short time. The markets are now drawing apart, and the normal 35 point difference between them—representing freight from west to east—is established. The behavior of these markets is a good illustration of how slowly and carefully the New York price, which is the more stable, moves. Advances are made only when justified by the market position—often slower than justified, some think. It is rare to find lead prices moving sharply forward or backward.

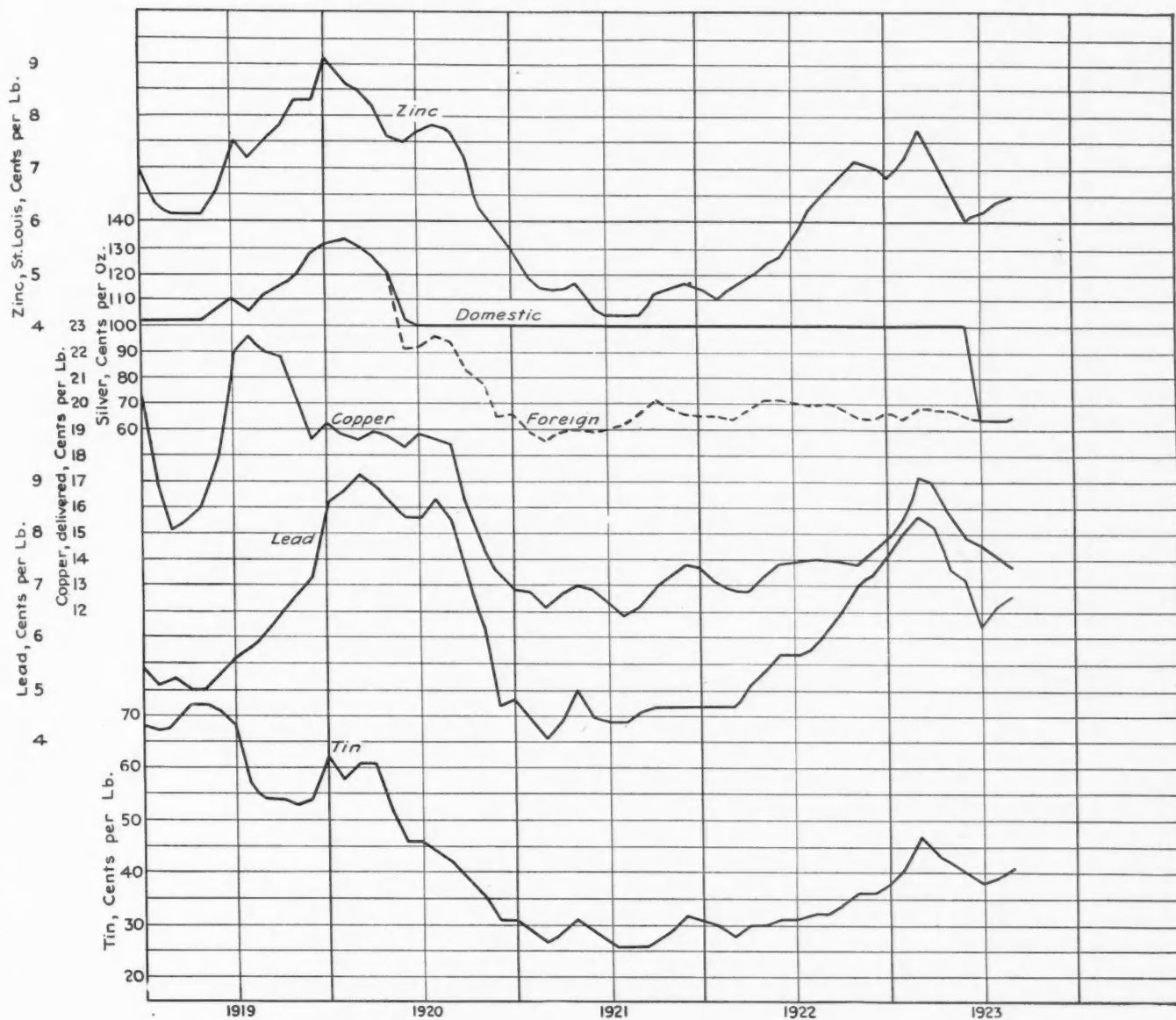
At least one consumer has expressed the belief that the present buying wave has irregularly showed a tendency to fall off, and that the price would have reflected this were it not for a simultaneous and offsetting decline in production. Just now lead producers are watching London rather closely, which they do anyway, as a sustained demand abroad will help considerably in maintaining the American price.

The announcement has just been made that the St. Joseph Lead Co. has purchased the mining and milling properties of the Federal Lead Co., a subsidiary of the A. S. & R., in the Flat River district of Missouri. The mining land of these two companies is contiguous, so much so that the holdings of one company are often interlocked or split up by the holdings of the other. The combination of the properties is a move toward more economical mining and transportation in the area in question. A year ago the St. Joseph Lead Co. took over the sale of the Bunker Hill & Sullivan lead from Idaho; the recent acquisition of Federal Lead further augments its industrial position. The St. Joseph Lead Co. now has almost as much lead to sell as the American Smelting & Refining Co.; the ratio is about 5 to 6 in favor of the smelting company.

It is understood that the Desloge Consolidated, which has had its production smelted at the Federal plant, will continue with the arrangement and sell its own pig lead. Although the Federal Lead Co. loses the sale of its former mine production, the lead produced from Joplin concentrates and miscellaneous sources will still supply a moderate amount of metal for disposal by the A. S. & R. The National Lead Co. is unaffected.

(a) American Bureau of Metal Statistics and Metallgesellschaft.

Fluctuations of Average Monthly Metal Prices 1919-1923



Mining Dividends in October

The following dividends were paid by mining and metallurgical companies in October:

Companies in the United States	Situation	Per Share	Total
Anaconda Copper	Various	\$0.75 Q	\$2,250,000
Bethlehem Steel	Various	1.25 Q	845,106
Cresson Consol. Gold	Colo.	0.10 Q	122,000
Eagle-Picher Lead	Various	2.25 X	180,000
Eagle-Picher Lead pfd.	Various	1.50	15,000
Homestake Mining, g.	S. D.	0.50 M	125,580
Inland Steel pfd.	Minn.	1.75 Q	175,000
Inspiration Consolidated Copper	Ariz.	0.50 Q	590,983
Iron Blossom Consolidated, s.e.l.	Utah	0.025 Q	25,000
Kennecott Copper	Alaska	0.75 Q	2,090,341
Mohawk Mining, c.	Mich.	1.00 I	100,000
Park City, s.l.z.	Utah	0.125 Q	109,500
Park Utah, s.l.	Utah	0.15 Q	150,000
Phelps Dodge Corporation, c.	Various	1.00 Q	500,000
Republic Iron & Steel pfd.	Various	3.75 Q	937,500
Silver King Coalition, s.l.z.	Utah	0.20 Q	243,220
Silver Wave Mining, s.l.	Utah	0.001 M	647
Sloss-Sheffield Steel & Iron pfd.	Ala.	1.75 Q	117,250
Tamarack & Custer, s.l.	Idaho	0.02 I	100,000
Teocopa Consolidated, s.l.	Calif.	0.015	45,000
Tennessee Copper & Chemical	Tenn.	0.25 Q	200,000
Tonopah Divide, s.g.	Nev.	0.10 I	101,480
Tonopah Extension, s.g.	Nev.	0.05 Q	69,636

Tonopah Mining, s.g.	Nev.	0.075 I	75,000
United Eastern, g.	Ariz.	0.15 Q	204,450
U. S. Smelting, Ref. & Mng. pfd., s.l.	Various	0.875 Q	425,556
Companies in other countries			
Asbestos Corporation	Quebec	1.00 Q	30,000
Asbestos Corporation pfd.	Quebec	1.50 Q	60,000
Dome Mines, g.	Ontario	1.00 Q	476,667
Hollinger Consolidated Gold	Ontario	0.05 4 wks.	246,000
Howe Sound, c.	B. C.	0.05 Q	99,207
Kerr Lake, s.	Ontario	0.125 Q	75,000
Lucky Tiger-Combination, c.s.	Sonora	0.10 Q	71,534
N. Y. & Honduras Rosario, g.s.	Honduras	0.25 Q	50,000
Nipissing, s.	Ontario	0.30 Q	360,000
Premier Gold	B. C.	0.08 Q	400,000
Silversmith Mines, s.l.z.	B. C.	0.01 Q	25,000
Wright-Hargreaves, g.	Ont.	0.025	68,750

Q, quarterly; X, a dividend of 11 1/2 per cent was also declared payable in common stock; M, monthly; I, irregularly; g, gold; s, silver; c, copper; l, lead; z, zinc.

Eagle-Picher Lead made a more generous distribution than usual this month, and Nipissing doubled its regular dividend. Several companies that have been somewhat irregular lately made payments, among them some of the Tonopah companies. The Asbestos Corporation reduced its preferred dividend from 7 to 6 per cent and its common dividend from 6 to 4 per cent. The six copper companies whose dividends normally come in October all made their usual distribution despite the low price of copper.

Company Reports

Wallaroo & Moonta Mining & Smelting Co.

Wallaroo; South Australia

The thirty-fourth report of the operations of the Wallaroo & Moonta Mining & Smelting Co. for the year ended June 30, 1923, follows:

The loss for the year is £77,801 13s. 8d., less the amount of interest received on government investments, £1,506 10s. 2d.

The realizable assets and cash liabilities of the company at June 30 last were:

Assets		£		s.		d.		£		s.		d.	
Investments—													
Commonwealth loan due 1923.....		480	0	0									
Commonwealth loan due 1930.....		20,000	0	0									
Copper Producers' Association, Pty., Ltd.....		100	0	0									
Gold Producers' Association, Ltd.....		0	15	0				20,580	15	0			
Refined copper, ores, and furnace products.....								46,377	17	3			
Stores, fuel and forage.....								108,323	16	7			
Sundry debtors.....								978	11	0			
Melbourne copper consignment acc't.....								226	18	9			
Cash in hand (Adelaide office).....								24	11	2			
								£176,512	9	9			
Less Liabilities		£		s.		d.		£		s.		d.	
Sundry creditors and dividends unclaimed.....		20,733	2	3									
Wages outstanding.....		3,643	0	0									
National Bank of Australasia, Ltd.....		137,543	2	8				161,919	4	11			
Balance of assets over liabilities.....								£14,593	4	10			

The total ore produced from veinstuff by separation and concentration was as follows:

	Wallaroo Mines		Moonta Mines	
	1922-1923	1921-1922	1922-1923	1921-1922
Ore produced, tons.....	16,991	11,971	5,296	3,884
Fine copper in ore, tons.....	1,442½	1,134	773½	517½
Percentage value, per cent.....	8.49	9.47	14.61	13.33

The cementation plant at Moonta Mines produced as follows:

	1922-1923	1921-1922
	Precipitate produced, tons.....	370
Fine copper in same, tons.....	257½	186
Precipitate value, per cent.....	69.66	65.49

The smelting works treated during the past twelve months:

Wallaroo Smelting Works		
Wallaroo mines ore, tons.....		16,445
Moonta mines, ore, tons.....		4,454
Moonta mines precipitate, tons.....		301
Outside ore, tons.....		473
		21,673

and produced the following metals:

Refined copper, tons.....	1,194
Electrolytic copper (included in above) tons.....	156
Blister copper (for export) tons.....	1,256
Gold (calculated as fine), oz.....	1,009
Silver (.996 fine), oz.....	617

The production of sulphuric acid was 1,400 tons.

At the beginning of the period under review mining operations were in abeyance, but production on a restricted scale has continued regularly since November, 1922. The quantity of ore mined has been limited, owing partly to the difficulty of securing a sufficient number of skilled miners to increase the output. The hoped for reduction in the price of fuel has not been realized, and the need to use coal of poorer quality during the stoppage of the Maitland field has added to the cost of production.

The company's output has again been sold to the Copper Producers' Association, Proprietary, Ltd., and part of the production is now being shipped overseas in the form of blister copper.

Facts for the Stockholder

XXIX—Kerr Lake Mines, Ltd.

Kerr Lake Mines, Ltd., was incorporated in Ontario, in October, 1917, as a reorganization of the Kerr Lake Mining Co. of New York, which was incorporated in New York, in September, 1905, as a holding company, to acquire the entire capital stock of the Kerr Lake Mining Co., Ltd. Operating control is in the hands of the General Development Co., a parent corporation.

The property in Ontario consists of about 62 acres of mineral land in Coleman Township, Nipissing district, together with 80 acres purchased from the Hargrave Consolidated Mines in 1921. In 1910, the company acquired 150,000 shares or 10 per cent of Wettlaufer Lorrain Silver Mines, Ltd.; and in 1915 it acquired 837,498 of the 1,000,000 shares of stock of the Caribou Cobalt Mines Co., which controls 70 acres adjoining the Kerr Lake property. In 1920, it obtained a majority interest in the Tahoe silver mine, in Utah, and in the Rimu Gold Dredging Co., in New Zealand. Ore reserves in the company's Ontario properties are practically exhausted, and its more important operations are centered in its other mining ventures.

The Tahoe property was placed in operation in December, 1919, with ore reserves estimated at about 87,000 tons, averaging 18 oz. silver and 80c. gold a ton, and equipped with a 150-ton mill. For the fiscal year ended Aug. 31, 1922, the mine had produced 977,606 oz. silver and 2,676 oz. gold.

On the Rimu property, a new dredge began operations in September, 1921. To Aug. 31, 1923, the dredge had recovered 14,139 oz. of gold. The prospected area consists of 880 acres, containing about 31,000,000 cu.yd., estimated to average 16c., and 32,000,000 averaging 10c. a cu.yd.

In 1922, the company took an option on stock of the Goldale Mines, Ltd., which will involve a controlling interest if the option is exercised. The property consists of 50 claims, having an area of 1,900 acres, in the Porcupine gold district of northern Ontario. Development on the 500 level was encouraging, and the work continued to a depth of 1,000 ft. About \$184,000 has been expended on development work.

Production of Kerr Lake Mining Co. for fiscal years ended Aug. 31 has been as follows: 2,433,793 oz. in 1916, 2,551,346 oz. in 1917, 2,582,993 oz. in 1918, 1,482,649 oz. in 1919, 956,049 oz. in 1920, 194,352 oz. in 1921, 3,988 oz. in 1922, and 8,268 oz. in 1923. Ounces of silver produced per ton of ore averaged as follows: 27.55 oz. per ton in 1916, 26.26 in 1917, 21.09 in 1918, 17.38 in 1919, 12.5 in 1920, and 8.4 in 1921.

Capital stock consists of 600,000 shares, par value \$4. The capital stock was reduced from \$3,000,000 in September, 1919, by reduction of par value from \$5 to \$4. There is no funded debt. At the close of 1921, there were 3,150 stockholders, compared with 3,230 in 1920, 4,314 in 1919, and 4,397 in 1918.

Earnings per share of capital stock are estimated as follows: \$1.09 in 1916, \$1.08 in 1917, 99c. in 1918, \$1.04 in 1919, \$1.53 in 1920, 80c. in 1921, 69c. in 1922, and 52c. in 1923. On Aug. 31, 1923, total current assets were \$1,260,195, against current liabilities of \$19,804, leaving net working capital at a little over \$1,200,000.

Dividend record of the new company in calendar years since organization is as follows: \$1 a share in 1918; \$1.50 in 1919, including a capital distribution of \$1 a share paid Sept. 22, 1919, the cash dividend passed in October; 12½c. in 1920, cash dividend resumed Oct. 15, 1920; 50c. in 1921; and 50c. in 1922.

The shares are listed on the Boston Stock Exchange and on the New York Curb, and are traded in on the unlisted department of the Toronto Stock Exchange.

Price range of the shares has been as follows: High, 6½ in 1919; low, 2¼ in 1923; closing price 2½, Oct. 23, 1923.

INVESTIGATOR.

MINING STOCKS

Week Ended October 20, 1923

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Ahmeek.....	Boston			58	June 23, Q \$1.50
Alaska-Br. Col.....	N. Y. Curb	*82	*80		
Allouez.....	Boston			*16	Mar. '19 1.00
Anaconda.....	New York	36½	35½	35½	Se. 15, Oc. 22, Q 0.75
Arcaidian Consol.....	Boston	1½	1½	1½	
Ariz. Com'l.....	Boston	9	8½	9	July '23, 0.50
Calaveras.....	N. Y. Curb	2½	2½	2½	
Calumet & Arizona.....	Boston	46	45	46	Se. 7, Se. 24, 1.00
Cal. & Hecla (New).....	Boston	19½	17½	18½	June '23, Q 10.00
Centennial.....	Boston	7	7	7	Dec. '18, SA 1.00
Cerro de Pasco.....	New York	39½	37½	38½	Oc. 18, No. 1, Q 1.00
Chile Copper.....	New York	26½	25½	25½	Se. 1, Se. 29, Q 0.62½
Chino.....	New York	17½	16½	16½	Sept. '20, Q 0.37½
Con. Cop. Min. (New).....	N. Y. Curb	2	2	2	
Copper Range.....	Boston	25½	25	25	May '23, Q 1.00
Crystal Copper.....	Boston Curb	69	62	66	
Davis-Daly.....	Boston	2½	2½	2½	Mar. '20, Q 0.25
East Butte.....	Boston	5½	5	5½	Dec. '19, A 0.50
First National.....	Boston Curb	31	25	25	Feb. '19, SA 0.15
Franklin.....	Boston	1.25	*80	1.00	
Gadsden Copper.....	Boston Curb	*35	*35	*35	
Granby Consol.....	New York	16	15½	15½	May '19, Q 1.25
Greene-Cananea.....	New York	15	15	15	Nov. '20, Q 0.50
Hancock.....	Boston	2½	2½	2½	
Howe Sound.....	N. Y. Curb	25	24	25	Oct. 1, Oc. 15 0.05
Inspiration Consol.....	New York	25	24	25	Se. 13, Oc. 1 Q 0.50
Iron Cap.....	Boston Curb	19½	19	19	May 23, K 0.15
Ile Royale.....	Boston	19½	19	19	Se. 1, Se. 15, 0.50
Kennecott.....	New York	32½	32	32½	Se. 7, Oc. 1, 0.75
Keweenaw.....	Boston	*75	*75	*75	
Lake Copper.....	Boston	1½	1½	1½	
Magma Copper.....	New York	29	28½	28½	Jan. '19, Q 0.50
Mason Valley.....	N. Y. Curb	1	1	1	
Mass Consolidated.....	Boston	1	1	1	Nov. '17, Q 1.00
Miami Copper.....	New York	23½	22½	22½	No. 1, No. 15, Q 0.50
Michigan.....	Boston	1	1	1	
Mohawk.....	Boston	*38½	*37	*37	Se. 22, Oc. 13, 1.00
Mother Lode Co.....	New York	8½	8½	8½	Je. 8, Je. 30, Q 0.50
Nevada Consol.....	New York	11½	11	11½	Sept. '20, Q 0.25
New Cornelia.....	Boston	*17	*16½	*17	Au. 3, Au. 20, Q 0.25
New Dominion.....	N. Y. Curb	2½	2½	2½	
North Butte.....	Boston	1½	1½	1½	Oct. '18, Q 0.25
Ohio Copper.....	N. Y. Curb	*90	*69	*90	
Old Dominion.....	Boston	15½	15	15	Dec. '18, Q 1.00
Oscoda.....	Boston	31½	31	31½	June '23, Q 1.00
Phelps Dodge.....	Open Mar.	†155	†140		Se. 20, Oc. 2 Q 1.00
Quincy.....	Boston	23	21	21	Mar. '20, Q 1.00
Ray Consolidated.....	New York	12½	11½	12½	Dec. '20, Q 0.25
Ray Hercules.....	N. Y. Curb	*39	*30	*33	
St. Mary's Min. Ld.....	Boston	32	32	32	Mar. '23, K 3.00
Seneca Copper.....	New York	7½	6½	7	
Shannon.....	Boston	*50	*45	*50	Nov. '17, Q 0.25
Shattuck Arizona.....	New York	5	5	5	Jan. '20, Q 0.25
South Lake.....	Boston			*98	
Superior & Boston.....	Boston	1	1	1	
Tenn. C. & C. cfs.....	New York	9	8½	8½	Se. 29, Oc. 15, Q 0.25
Tuolumne.....	Boston	*85	*85	*85	May '13, 0.10
United Verde Ex.....	N. Y. Curb	28	27½	27½	Oct. 5, No. 1, Q 1.00
Utah Consol.....	Boston	1	*95	*95	Sept. '18, 0.25
Utah Copper.....	New York	57½	57½	57½	Se. 14, Se. 29, Q 1.00
Utah Metal & T.....	Boston	*60	*55	*55	Dec. '17, 0.30
Victoria.....	Boston			*75	
Winona.....	Boston	*35	*30	*30	
Wolverine.....	Boston	6½	6½	6½	
NICKEL-COPPER					
Internat. Nickel.....	New York	11½	11	11½	Mar. '19, 0.50
Internat. Nickel pfd.....	New York	76½	76½	76½	Oct. 11, No. 1 Q 1.50
LEAD					
Carnegie Lead & Zinc	Pittsburgh	2½	2½	2½	
National Lead.....	New York	120	118½	118½	No. 22, Dec. 15 Q 1.75
National Lead pfd.....	New York			111	Au. 24, Se. 15 Q 1.75
St. Joseph Lead.....	New York	19½	19	19	Se. 9, Se. 20 Q, X 0.50
ZINC					
Am. Z. L. & S.....	New York	7½	7½	7½	May '20, 1.00
Am. Z. L. & S. pfd.....	New York	30½	30	30	Nov. '20, Q 1.50
Butte C. & Z.....	New York	5½	4½	4½	Mar. '23, 0.50
Butte & Superior.....	New York	14	13	14	Je. 15, Je. 30, Q 0.50
Callahan Zn-Ld.....	New York	4½	4½	4½	Dec. '20, Q 0.50
New Jersey Zn.....	N. Y. Curb	142½	142½	142½	Oct. 31, No. 10, Q 2.00
United Zinc.....	N. Y. Curb	*50			
Yellow Pine.....	Los Angeles	*70	*70	*70	June '23, Q 0.03
SILVER					
Alvarado.....	N. Y. Curb			1½	
Batopilas Mining.....	New York				Dec. '07, 1 0.12½
Beaver Consol.....	Toronto	*30	*28½	*28	May '20, K 0.03
Candelaria.....	N. Y. Curb	*4	*2	*4	
Castle-Trethewey.....	Toronto	*35	*32½	*34	
Coniagas.....	Toronto	2.40	2.40	2.40	May '21, Q 0.12½
Crown Reserve.....	Toronto	*63	*61	*62	Jan. '17, 0.05
Kerr Lake.....	N. Y. Curb	2½	2½	2½	Oct. 1, Oc. 15, Q 0.12½
La Rose.....	Toronto	*25	*24	*25	Apr. '22, 0.10
McKinley-Dar-Sav.....	Toronto	*13	*11	*12	Oct. '20, Q 0.03
Mining Corp. Can.....	Toronto	2.97	2.86	2.89	Sept. '20, Q 0.12½
Nipissing.....	N. Y. Curb	5½	5½	5½	Se. 3, Oc. 17, Q 0.30
Tntario Silver.....	N. Y. Curb			6½	Jan. '19, Q 0.50
Oemiskaming.....	Toronto	*35	*33	*34	Jan. '20, K 0.04

Stock	Exch.	High	Low	Last	Last Div.
GOLD					
Alaska Gold.....	New York	1½			
Alaska Juneau.....	New York	1½			
Boundary Red M.....	N. Y. Curb			*12	
Carson Hill.....	Boston	3½	3½	3½	
Cresson Consol. G.....	N. Y. Curb	37½	37	37	Se. 30, Oc. 10, Q 0.10
Dome Mines.....	New York	37½	37	37	Oc. 12, No. 1, Q 1.75
Golden Cycle.....	Colo. Springs	1.08	1.08	1.08	Dec. '22, Q 0.02
Hollinger Consol.....	Toronto	11.15	11.05	11.10	Oc. 18, No. 25, M. 0.05
Honestake Mining.....	New York	61½	61	61	Oct. 20, Oc. 25 M 0.50
Kirkland Lake.....	Toronto	*40	*39	*39	
Lake Shore.....	Toronto	3.53	3.37	3.50	Au. 1, Au. 15 '23, Q 0.02
McIntyre-Porcupine.....	New York	16½	16½	16½	Au. 1, Se. 1, Q 0.25
Portland.....	Colo. Springs	*30	*30	*30	Oct. '20, Q 0.01
Teck-Hughes.....	N. Y. Curb	1½	1½	1½	
Tom Reed.....	Los Angeles	*60	*53½	*60	Dec. '19, 0.02
United Eastern.....	N. Y. Curb	1½	1½	1½	Oc. 8, Oc. 28, Q 9.15
Vipond Cons.....	Toronto	*90	*89½	*89½	
Wright-Hargreaves.....	Toronto	3.25	3.00	3.10	Se. 15, Oc. 1, Q 0.02½
Yukon Gold.....	N. Y. Curb	*81	*81	*81	June '18, 0.02½
GOLD AND SILVER					
Boston-Mont. Corp.....	N. Y. Curb	*12	*12	*12	
Con. Cortez.....	N. Y. Curb	*50	*48	*49	
Con. Virginia.....	San Francisco	8½	8	8	
Continental Mines.....	N. Y. Curb	4½	4	4	
Dolores Esperanza.....	N. Y. Curb	*92	*92	*92	Jy. 1, Jy. 10 Q 0.05
Jib Consol.....	N. Y. Curb	*65	*65	*65	
Tonopah Belmont.....	N. Y. Curb	*65	*60	*65	Apr. '23, Q 0.05
Tonopah Divide.....	N. Y. Curb			*42	Se. 22, Oc. 10 0.10
Tonopah Extension.....	N. Y. Curb	2½	1½	1½	Se. 10, Oc. 1 0.05
Tonopah Mining.....	N. Y. Curb	1½	1½	1½	Se. 30, Oc. 1 0.07½
Unity Gold.....	N. Y. Curb	3½	3	3	
West End Consol.....	N. Y. Curb	*74	*72	*72	Mar. '23, Q 0.05
SILVER-LEAD					
Bingham Mines.....	Boston			16½	Sept. 19, Q 0.25
Cardiff M. & M.....	Salt Lake	*85	*85	*85	Dec. '20, 1.00
Chief Consol.....	Boston Curb	4½	3½	4	Au. 1, '23, Q 0.10
Columbus Rexall.....	Salt Lake	*38	*35	*37	Aug. '22, 0.03
Consol. M. & S.....	Montreal	26½	26½	26½	Oct. '20, Q 0.62½
Erup. M. & S.....	Boston Curb	2½	2½	2½	Se. 15, Oc. 2 0.125
Federal M. & S.....	New York	8	8	8	Jan. '09, 1.50
Federal M. & S. pfd.....	New York	39½	39	39	Au. 25, Se. 15, 1.75
Florence Silver.....	Spokane	*15	*12	*13	Apr. '19, Q, X 0.01½
Hecla Mining.....	N. Y. Curb	8½	8½	8½	Au. 15, Se. 15 0.15
Iron Blossom Con.....	N. Y. Curb			*31	Oct. 25, '23, 0.02½
Marsh Mines.....	N. Y. Curb	*12	*10	*12	June '21, I 0.02
Park City.....	Salt Lake			3.20	Se. 15, Oc. 1 Q 0.15
Park Utah.....	N. Y. Curb			3	Se. 15, Oc. 1 Q 0.15
Prince Consol.....	Salt Lake	*75	*75	*75	Nov. '17, 0.02½
Silversmith.....	Spokane	*35	*33	*35	Oc. 1, Oc. 10 0.01
Simon Silver-Lead.....	N. Y. Curb	*9	*9	*9	
Snowstorm Silver-L.....	N. Y. Curb			*45	
Tamarack-Custer.....	Spokane	1.40	1.40	1.40	Se. 30, Oc. 1, K 0.02
Tintic Standard.....	Salt Lake	3.55	3.37½	3.37½	Se. 24, Se. 29 0.15
Utah-Apex.....	Boston	3	2½	3	June '23, Q, X 0.50
IRON					
Bethlehem Steel.....	New York	48½	46½	48½	Se. 1, Oc. 1 Q 1.25
Char. Iron pfd.....	Detroit	1	1	1	
Char. Iron.....	Detroit			25½	Au. 10, Au. 25 Q 2.00
Colorado Fuel & Iron	New York	26½	25½	26½	Feb. '23, Q 2.00
Col. Fuel & Iron pfd.....	New York	29½	28	29½	Apr. '23 1.00
Gt. North'n Iron Ore	New York	29½	28	29½	Apr. 15, Se. 1 '23 Q 0.62½
Inland Steel.....	N. Y. Curb			5	
Messabi Iron.....	N. Y. Curb	9	8½	8½	
Republic Steel.....	New York	44½	42½	44	May '21 1.50
Republic I. S. pfd.....	New York	89	86½	89	Se. 15, Oc. 1 Q 3.75
Sloss-Sheffield S. & I.	New York	40½	39½	40½	Feb. '21, 1.50
Sloss-Shef. S. & I. pfd.....	New York			78	Se. 2, Oc. 1, Q 1.75
U. S. Steel.....	New York	88½	85½	85½	Au. 30, Se. 29 Q 1.25
U. S. Steel pfd.....	New York	119½	118½	118½	Au. 7, Au. 30 Q 1.75
Virginia I. C. & C.....	New York	54	52½	52½	Je. 16, Jy. 2 2.00
Virginia I. C. & C. pfd.....	New York			81	Je. 16, Jy. 2 2.50
VANADIUM					
Vanadium Corp.....	New York	29½	27	28½	Jan. '21, Q 1.00
ASBESTOS					
Asbestos Corp.....	Montreal	44	44	44	Se. 29, Oc. 15 Q 1.00
Asbestos Corp. pfd.....	Montreal	71½	71½	71½	Se. 29, Oc. 15 Q 1.50
SULPHUR					
Freeport Texas.....	New York	12	11½	11½	Nov. '19, Q 1.00
Texas Gulf.....	New York	58½	56½	58	Se. 1, Se. 15 Q 1.50
PLATINUM					
So. Am. Gold & P.....	N. Y. Curb	4	3½	3½	
MINING, SMELTING AND REFINING					
Amer. Metal.....	New York	45½	43	45	Au. 20, Se. 1 0.75
Amer. Metal pfd.....	New York	111	111	111	Au. 18, Se. 1 1.75
Amer. Sm. & Ref.....	New York	56½	55	55½	Oc. 11, No. 1, Q 1.25
Amer. Sm. & Ref. pfd.....	New York	97½	97	97	No. 9, Dec. 1, 1.75
U. S. Sm. R. & M.....	New York	21	20½	20½	Jan. '21, Q 0.50
U. S. Sm. R. & M. pfd.....	New York	40	40	40	Oc. 8, Oc. 15 Q 0.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.
 Toronto

NEW MACHINERY AND INVENTIONS

An Electric Motor for Use in Small Bore Holes

Up to the present it had not been possible to construct a pump, directly coupled to an electric motor, that could be used in drill holes or artesian wells of small diameter, because there were no electric motors of the required size powerful enough to do the work and which could be kept submerged in water or oil for any length of time without

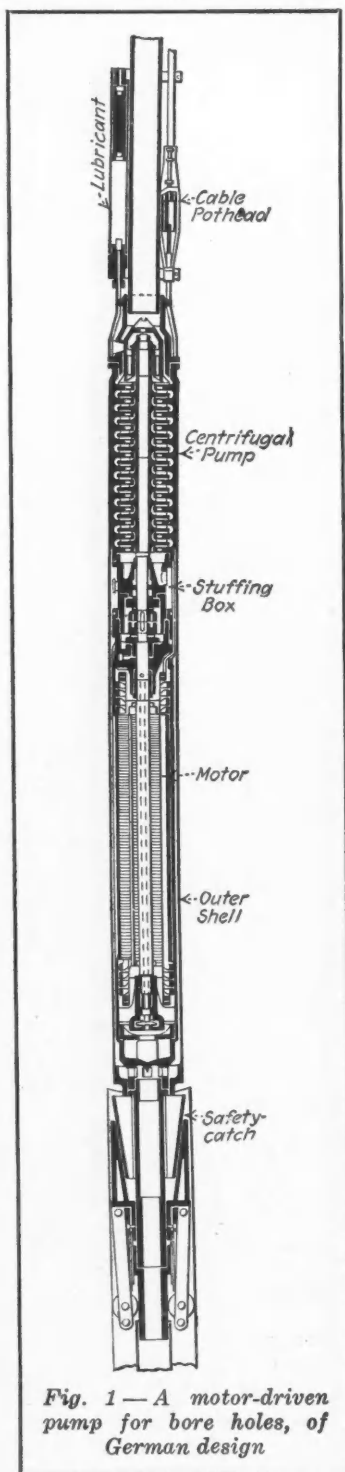


Fig. 1—A motor-driven pump for bore holes, of German design

seriously impairing their efficiency, according to *Elektrotechnische Zeitschrift* (Berlin) of July 26, 1923.

The Reda-Electro motor of the Arutünoff Company solves this problem. It is an air-and water-tight, explosion-proof and high-speed 3-phase motor directly coupled to a pump with vertical shaft (Fig. 1). The small diameter naturally necessitates an elongated form. This again calls for a specially efficient cooling system, which in the Reda motor is accomplished by oil which is kept in circulation by a small pressure pump on the end of the shaft. The cooling oil at the same time takes care of lubrication of all friction surfaces. Impurities can settle in a special chamber. The overload it can carry by work in liquids reaches the standards of the V.D.E. for open motors. The efficiency is equally favorable.

The motor is manufactured in any capacity required; if necessary also for 1,000-2,000 volts.

In motors of more than 5 hp. the short-circuit slides are provided with a special automatic starting device which makes the otherwise needed rings, brushes and brush-holders, and resistance unnecessary.

The starter is also made for open motors under the name "Armotor." The starting current fluctuates between the desired and allowable limits.

Installation of special conductors from the rings of the motor to the starting box can be dispensed with.

On overload, the rotor does not burn out, which is a great advantage and important economical factor.

The Reda motor connected to a pump for use in oil wells and as a house pump has been built recently by the Reda Motoren Verwertungs Gesellschaft. A 40-hp. installation was recently installed in Grosny. It functioned under water at 2,000 volts and 3,000 r.p.m.

The radiation of the motor is so well provided for that the pump functions properly even in the hottest liquids. Good results have been obtained in water of 80 deg. C. The current reaches the motor by means of an isolated cable alongside the pressure pipe and ends immediately above the pump in a cable pothead.

The Reda motor is provided with automatically tightening stuffing boxes (Arutünoff system), the functioning of which is based on the principle of hydraulic pressure compensation. The penetration of foreign substances in the motor is thus prevented, since the outside pressure is always somewhat higher than the inside one.

A short time ago a new Reda Electro Pump was completed, working with the usual 380-volt current. The efficiency proved to be 50 to 60 per cent.

An Advance in the Art of Sawing Metals

From England comes notice of improved apparatus for sawing metals which is said to allow the work to be done in half the usual time. Furthermore, the saw blades will last from six

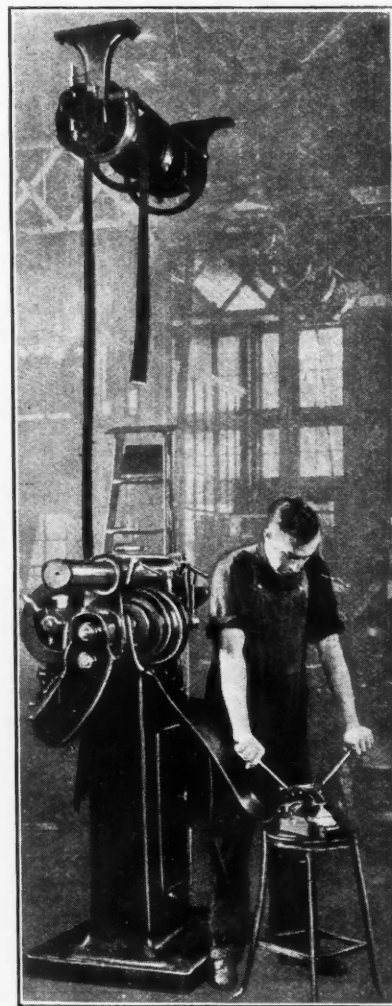
to ten times as long as blades usually do.

The improvement is due to three things. First, a saw blade made of high-speed steel containing 18 per cent tungsten and which has a patent set enabling it to be sharpened many times. Second, a saw grinding machine of novel design which forms the correct shape of tooth. Third, a sawing machine designed to run at a high speed.

The manufacturers of this equipment, Edward G. Herbert, Ltd., Chapel St., Levenshulme, Manchester, England, have given the trade name "Rapidor" to this device.

New Machine Repairs Belts Without Removing From Shaft

A portable machine weighing 24 lb. which can easily be carried to broken or stretched belts has been developed by a Michigan firm. A square belt is inserted into the slotted opening without



Repairing belt in a shop

removing the belt from the shafting when using this device. By working the levers, the hooks are pressed into the belt and are left flush with the surface. It is claimed that the hooks used will stand a pulling strain equal to over 400 lb. per inch of belt. This machine is manufactured by the Clipper Belt Lacer Co., of Grand Rapids, Mich.