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# ENGINEERING AND MINING JOURNAL-PRESS

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— WHERE MINE AND QUARRY MEET —

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Mining Limestone at Ste. Genevieve, Mo.  
by Ralph W. Smith

Australia: The Infant in the Iron Industry  
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Flexibility in Mill Design  
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# ENGINEERING AND MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 120

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Number 24

## German Potash Financing

**A** PROJECTED LOAN by American bankers to the German potash syndicate has been cancelled, according to newspaper reports, by suggestion of the Washington government. The wisdom of such a course is open to question. It rests upon a desire to resist foreign monopolies which may impose their own prices upon American consumers. And potash is in the large sense a monopoly, as it is the German-French potash fields to which the United States must look for its potash; since this is the only large natural supply in the world, and byproduct and synthetic potash salts are naturally more expensive to produce. French and German potash fields have entered into a combination and have distributed the world's markets. It is hardly possible, therefore, that we will buy elsewhere: and certain American monopolies, like the aluminum monopoly and others, do not hesitate to partition the economic market for their products.

Such an excellent business proposition will be financed, if not in this country, probably in England. The holding of a substantial mortgage on the potash fields, moreover, is one that would inure to American influence—so much, indeed, that such moves are not popular in German politics. Finally, it would help Germany meet her reparation payments, which would benefit the world and us. It may be, of course, that the American government thinks to influence some unknown development of a more favorable nature, such as the dissolution of the Franco-German potash combine: but if so there is no indication of it.

## Introducing Chromium to the Commercial World

**M**ETALLIC CHROMIUM, according to the office Webster which was published in 1911, has no commercial use, but that was fourteen years ago. Even then, chromium had been known for over a hundred years, but only its compounds had been found of value—ferrochrome in the manufacture of chrome steel, the ore as a refractory material, and chromium salts in the tanning and dyeing industries and for pigments. More recently, we have come to demand the so-called stainless steel for household cutlery, which is a steel containing 12 to 14 per cent chromium, and occasional reports have appeared in the technical press of successful electro-plating with chromium.

Dr. E. E. Free, science editor of *The Forum*, points out some of the latest applications of this, "A New Metal," in the December issue. The thin, hard and tough film of electrically plated chromium has been found by Robert Piersol, of the Westinghouse company, to be superior to anything known for the reflectors used in high-power stage and flood lights, and it may be used in automobile headlights, too. The coating will stand the heat, and it does not tarnish. A thin layer of chromium on cutting tools is said to be beneficial, both

in improving their cutting power and in preventing rust. It is suggested, in fact, that our table silverware be plated with this metal, for in appearance it is a good deal like silver. Cheap jewelry is another application; perhaps no longer will the five-cent collar button leave its green stamp on the neck of him who chooses to use it.

So does another one of the old rare metals graduate from the ranks of the laboratory curiosities.

## The Need for More Earth Science Investigation

**T**HAT PURE SCIENCE has become submerged in the United States is a lament which we have often voiced in these columns, and especially with reference to that most fundamental of all sciences—earth science, beloved of miners. Therefore it was with instant applause that we heard Herbert Hoover's speech at the annual meeting of the American Society of Mechanical Engineers on Dec. 1. Mr. Hoover pointed out, as a telling comparison, that the amount of money annually expended in the United States for pure science is less than one-tenth of what we spend for cosmetics. "Instead of leading all the other countries in the advancement of fundamental scientific knowledge," said Mr. Hoover, "the United States occupies a position far in the rear of the majority of European nations." Mr. Hoover rightly pointed out that we need no longer expect great discoveries from lone workers experimenting without resources; at least we should not rely upon such occasional chances. We need, he truly observes, "A host of men, great equipment, long, patient, scientific experiment to build up the structure of knowledge, not stone by stone, but grain by grain."

The total amount expended in this country in the development of all pure science, according to Mr. Hoover, does not exceed \$10,000,000 a year: while industrial science consumes \$200,000,000 annually. But the progress of industrial science is based on occasional discoveries of maximum importance in the field of pure science, which not only thus serves industry but advances the knowledge of the riddle of life.

It is in recognition of this fundamental hiatus in the investigation of earth sciences that we have from time to time, editorially and otherwise, and especially in our leading editorial of Sept. 13, 1924, advocated the establishing of an Institute for Geologic Research—an organization which would fill a gap in the structure of geologic investigation, not only in this country but for the world. This plan has received in its preliminary stages the general approval of the most important existing institutions engaged in geologic research—government, university, and endowed institutions. We quote from our leading editorial of Sept. 13, 1924, on the subject: "There is no organization properly prepared to push research questions promptly and persistently: the universities are occupied with their



teaching, the government and state bureaus of mines and geology are occupied with surveys which are demanded as of immediate economic importance. The National Research Council has no funds or organization for actively carrying on work. It can only advise and co-ordinate. All of these elements in the organization of geological science have expressed their approval of the plan of an endowed Institute for Geological Research." But for the carrying out of these plans, funds, as Mr. Hoover points out, are necessary.

### Young American Engineers in Old Mexico

**T**HE MINES, MILLS, AND SMELTERS of Mexico, by and large, are run by American engineers. The significance of this is emphasized by the fact that of the total world's production nearly 40 per cent of the silver and 14 per cent of the lead, together with important quantities of gold, copper, and zinc, come from that minerally fertile country. Most of these engineers are young in years; the others are young in habits and ideas. Many important properties are in charge of men who have yet to see their fortieth birthday, and incidentally most of them started with some such work as bucking samples, holding a plumb bob, opening cyanide cases, or pushing a car. That Americans should predominate is natural for the reason that American capital is behind most of the enterprises. But, on the other hand, many mines owned by European corporations likewise are operated by Americans. Within the last year at least three companies have displaced European managers with Americans, with the result that losing operations have been converted into profitable ones.

The gradual exhaustion of many of the bonanza orebodies that could be mined profitably in spite of inefficient management has made the race one only for the fittest. There is no stopping to take tea in the afternoon. While liquor is to be had, and some is used, there is no habitual absorbing of whisky and soda at the club each afternoon and evening, to be followed by dulled wits the next morning. Some of these young Americans may let down the bars once a fortnight or once a month, but for the most part they are like the average engineer working in the United States. They take their jobs seriously. They must show results or get out, and they generally show results. They come from all parts of the country: from "Tech," from Columbia, from Houghton, from Missouri, from Golden, from Utah, from California, and from a dozen other schools.

If ever there was any truth in the notion that only those went to Mexico who could not "make the grade" at home, it does not hold today. Conditions in many respects are trying; problems must be solved that never confront the operator in the United States and Canada. But, from the manager down, each man has a task to perform, and the overwhelming proportion are succeeding splendidly.

### Lawyers and Engineers in Arkansas

**A** FRIEND FROM MISSOURI sends us a mining report which was submitted to him, with an accompanying letter from an Arkansas attorney. The attorney writes:

"It is generally believed by all of the old miners in that District, that I have the best lead lands to be had in any

section of the mining district. One can find out crops and begin digging out lead in paying quantities, so I am informed.

"Mr. Morgin after having visited the property and spending several days looking over the country, he went to Joplin, where he could make out the report and make an assay of some of the lead; the original of his report I have in my possession. Mr. Morgain being an experiance Engineer with several years in Mexico and other mining districts."

The engineer, Mr. T. P. Morgan, "Geologist and Mining Engineer," of Mexico City, reports thus in part on the property:

"After making a careful Geological Survey of the above described properties as to the extent of mineral deposits I find large quantities of commerciable ores namely lead and zinc. I find that this particular region has gone through two series of disturbances and so great were the disturbances, until all of the sedimentary formation i.e. limestone are sitting on an angle of 45 to 75 degrees., and in most parts intrusions of Magma forming many dykes and sylles and running for many miles in length through this particular part of Marion County with a strike from South West to the North East, and in texture from a dark red to almost white, and we find from the fossills that the age of those Igneous rockes or ore bearing rocks, known as sedimentary or blue lime stone bodies of chest which are usually brecciated or impregnated with dolomite, Jasperoid, Calcite or Spahlerite, Greenockite, Barite, in this district to be one Hundred thousand years, and according to age and the country perforated with so many springs and heavy rain falls you can look forward to very rich and large deposits of lead and zinc ores which is caused by the ascending and decending waters.

"I find two systems of deposits on this property, one known as Fisher vein deposits, lying between the line and the Brecciated, Rhyolitic formation. And the other a blanket or sheet ground deposit, nearly horizontal, tabular ore bodies, many of them of great lateral extent, developed paralell to the bedding plains of the rocks, these are but phases of the structural relations of the ore bodies, and manifestations of the Genetic dependents of the Topograph, aerial geology and economic geology on the geological and metriogical structure."

Nature, as has been observed before, is wonderful. And Mr. Morgan has discovered what true Fisher veins are. What do they fish for? Suckers.

### New Mining Curricula at Columbia University

**C**OLUMBIA UNIVERSITY, which put into operation some years ago a mining engineering program entailing the basic plan of six years' instruction, has recently published another program. The six-year course proved to be unworkable and was therefore changed by offering alternatives of four and five year curricula in addition to the six-year basic plan.

The exigencies of the present situation in mining education are illustrated by the fact that technical instruction allows five options or as many different curricula—mining engineering, mining geology, ore dressing, metallurgy, and physical metallurgy. Under each of these, the four-, five-, and six-year plans are applicable. The technical program involves three years in each option, but a student may elect a two-year pre-engineering course, supplementing this with the first two years of a given technical option, or he may elect a three-year pre-engineering course, supplementing this with the first year of the technical option. Under the five-year plan a student may elect the two-year pre-engineering course and complete a technical option. This is apparently a rational arrangement designed to meet the demands of students who may not desire or who cannot afford to devote more than four or five years to their university training. It indicates, also, the degree of specialization that is characteristic of the



mining industries and which has additional ramifications not specifically covered by the curricula in question.

We cannot go into the detail of the various curricula, but the pre-engineering course prescribes the usual fundamentals, English, mathematics, chemistry, and physics. Modern languages, drafting, economics, and contemporary civilization are included. It is largely individual opinion as to whether this is a well-balanced ration or not. The technical curriculum in mining engineering develops geology and mineralogy, mechanics and its applications in design, electrical engineering and thermodynamics, elements of mining, ore dressing, general metallurgy, and the metallurgy of important metals. There are the usual summation courses and the bread-and-butter courses such as assaying and surveying. As far as a prescribed program can go, it appears to cover the important features. Other technical options follow the principles of the course in mining engineering.

Any mining curriculum represents the digested thoughts of several individuals and is merely a standard route or time-table for the student who subscribes to it. The potent vitalizing elements are the student himself and the teachers who are to present the various subjects. To carry such a program to success requires hard work and no little inspiration on the part of both student and instructor.

### The Rewards of Industry

THE COST OF LIVING has been going up during the last months, in accordance with the slight inflation of prices in general. But the cost is less by 17 per cent than in 1920. These and similar other facts are called attention to in a recent bulletin of the National Industrial Conference Board of New York. Food is 26 per cent cheaper than in 1920, clothing 33.8 per cent cheaper, fuel 4.7 per cent cheaper; while shelter is 12.7 per cent higher and light 25 per cent.

To go back to pre-war prices, as exemplified in 1914, the general increase as shown in 1925 prices still remains 69.7 per cent, as compared with 104.5 per cent increase in 1920 over 1914; and the present purchasing value of the dollar is 58.9 cents as compared with the 1914 dollar at par.

A recent bulletin from the same organization which we recently cited editorially showed that the "real" wages of workmen—that is, the amount of necessities that the workman's wage will buy—has increased very materially since 1914. The board has apparently not investigated the metal-mining industries as a separate study; and a casual survey of these industries reveals the fact that in the United States both the professional men of the mining industry (that is, the engineers, surveyors, assayers, and superintendents) and the miners have suffered a loss of "real" wages since 1914. This is notoriously not true of coal mining, at least so far as mine labor is concerned. But it is true not only of mining engineers, but of engineers in general, as has often been illustrated. Engineering training still represents a good training for life; but many who have received this shy off from engineering practice and engage in some form of commerce. The perception of this has reduced the number of engineer students and increased the crowd of those young men who, having studied some engineering, decide to abandon it for some other line of activity. Not only have the financial rewards decreased, but the social standing of professional men has moved downward.

### Has the Boomer Disappeared?

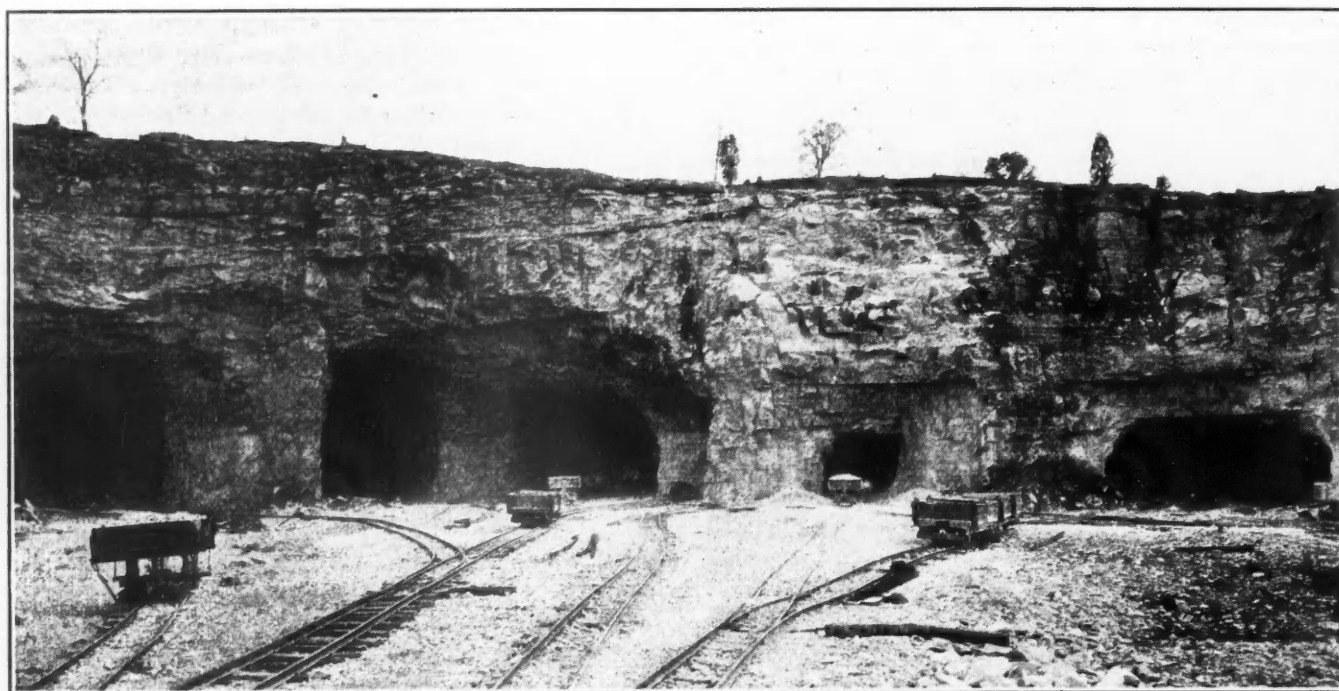
A STRIKING PICTURE of the deserted mining camp of the West was presented recently by a writer in a popular magazine of national circulation. No words were minced in describing what happens when "the paystreak runs into the wall," or when luck fails. Such a portrayal of the hazards and vicissitudes of mining is not often presented to the public, accustomed as it is to having only the bonanza and the romance of sudden wealth played up. Perhaps the writer went a bit too far. The boomers are extinct, he said, or words to that effect; those willing to take a long shot are no longer interested in mining, which today is done in a strictly business way. Any reader of the article would scarcely at the moment have been a likely prospect for a mine promoter. So doleful a picture was painted of the investor's chances that some one has inquired whether the article was not a subtle form of propaganda by the "big interests" (of course) to deter the public from aiding the development of prospects in order that they might the more easily be picked up by the interests.

The author was wrong, however. The boomer has not disappeared—witness the hundreds of millions spent by small investors, speculators, or gamblers on oil schemes, honest or otherwise, in the last few years. Witness the Divide boom of only six years ago, which petered out when it was found that there was little or nothing to warrant it. Witness the Florida real estate boom and a dozen other similar booms in various parts of the country. Even today mining stock is being peddled freely throughout the country and finding purchasers on the strength of no other information than the prospectus and the assertions of the salesman. A new bonanza—another Leadville—would help kindle a wild excitement. The public is ever changing as the sophisticated pass out and the unsophisticated enter.

### Mining Machinery Helps Horticulture

ONE IS APT TO THINK of mining as occupying a more or less isolated niche among the industries, but it is a basic industry, and the solution of its many problems in both rock excavation and in ore treatment has helped solve the problems of many other industries. Slime filtration introduced continuous filtration to the chemical industry. The mechanicalization of the cyanide process afforded other devices to this same industry. The hand-held drill of the miner became metamorphosed into the paving breaker and into the tamping iron for railroad track work. The portable compressor which was developed for road work has been adopted for prospecting and initial development.

It is interesting to note that the hand-held drill and the portable compressor rig are likely to become part of the equipment of the orchardist and may in time become almost as useful as the plow and the cultivator. We refer to the comparatively recent introduction of the Spencer method of soil aeration. In this method a pointed, hollow steel bar is driven into the ground to a depth of several feet by means of a hand-held drill. The drill is then disconnected and an air hose attached to the bar and compressed air turned into the soil. The immediate effect is to loosen the soil over a considerable radius. The result is claimed to be an important change in the physical condition of the soil. Earthbound trees and orchards, we are told, have been greatly improved by this treatment.



Where the underground workings of the Peerless White Lime Co. meet the open quarry, Ste. Genevieve, Mo.

## Mining Limestone at Ste. Genevieve, Mo.

*Underground Extraction Naturally Superseded Quarrying From the Surface as Overburden Became Too Heavy—New Method Has Its Own Advantages*

By Ralph W. Smith

Mine Superintendent Peerless White Lime Co., Ste. Genevieve, Mo.

**T**HE MARGIN OF PROFIT in lime burning is such that limestone must be produced on a low-cost basis, and in the early developments of the industry (as well as today) open quarries, with resultant low production costs, were prevalent. Of recent years a considerable number of plants have begun to produce stone from underground quarries and are paying the increase in cost which results from mining. It is obvious that this change in operations has not been made arbitrarily, but is an economic condition justified by other factors than those disclosed by a superficial survey of plant conditions. An interesting illustration of this change is furnished by the plant at Ste. Genevieve, Mo., of the Peerless White Lime Co., a subsidiary of the Hunkins Willis Lime & Cement Co. This company operated an open quarry for thirteen years and then began underground operations in 1921.

The plant is situated two miles west of Ste. Genevieve. It was put in operation in 1908 with two stack kilns, and the first stone was produced from a small open quarry which was started at the foot of a hill about 300 ft. from the kilns. There was little soil over the rock at this point, and each additional row of holes gave added depth. This combination made possible a low-cost rock. As the operation expanded, additional kilns were erected from time to time and the open quarry ate into the hillside more rapidly. In 1920 there were eight kilns, with maximum requirements of 375 tons of rock, including spalls, per day.

The limestone available for burning at Ste. Genevieve

is the upper 60 or 70 ft. of the Spergen formation, which underlies large portions of Ste. Genevieve County. It dips roughly 2 deg. 20 min. east (about equal to a 4 per cent grade) and outcrops somewhat parallel to the Mississippi River and two miles west. The Spergen formation is 160 ft. thick here, but the lower portions are not pure enough for the high-chemical lime in which the company specializes. Above the Spergen and conformable with it is the St. Louis limestone, a cherty and impure member of the Mississippi group, unavailable for lime burning.

As the quarry advanced up the hill it met the St. Louis formation, thin at first but becoming thicker with each foot of advance. At first it was shot down with the underlying limestone and sorted out on the quarry floor. Before long, however, it was 30 ft. thick, and this accounts for the gradual transition of the Peerless company's open quarry to a so-called "underground quarry." Mining operations were begun in 1921 and quickly showed other advantages over those in the open quarry: A cleaner grade of stone, free from adhering clay and mud, could be supplied to the kilns, this being of value in making high-chemical lime, and mining operations were not affected by adverse weather.

### MINE OPENED FROM QUARRY PIT

The first openings were driven from the face of the open quarry about 8 ft. by 35 ft. on the level of the quarry floor to the property limits (only 150 ft. at this point), and about 40 ft. of the rock was later removed from the back of these rooms by a semi-shrinkage sys-



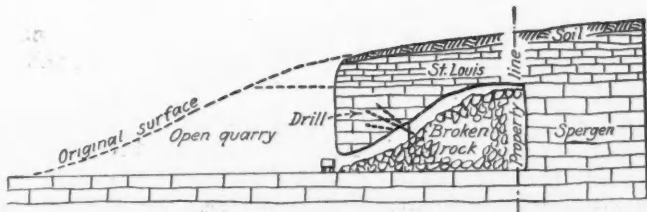


Fig. 1—Earlier method of mining used by Peerless White Lime Co.

tem of "flat-holing" from the top of the pile. Part of the rock was continuously loaded away from the foot of the pile to allow for the swell from additional mining. Long ribs, 15 ft. thick, were left between rooms. Fig. 1 illustrates this method. At this time a considerable number of loading tracks were available in the open quarry. Thus the burden of production did not fall upon the underground openings, and a few underground tracks were sufficient.

There were several unsatisfactory features of this first mining procedure. It is a curious anomaly that the product from a limestone mine or quarry is practically 100 per cent ore, yet approximately 25 per cent of this is rejected because of its size (unless special and more costly provision is made to utilize it). Nothing under 4 in. is sent to the kilns. Drilling the stone by "flat-holes" somewhat parallel to the bedding planes results in a larger percentage of spalls than does drilling by stope holes across the beds, whether the stope holes are in the back or on a bench.

The semi-shrinkage system of removing part of the rock continuously from the foot of the pile gave a cumulative result which was not satisfactory. The large rocks from the shots rolled to the foot of the pile, and were broken up and loaded out. The spalls from these large rocks were left, and new rock was shot down on top of them. Thus a stope produced an abnormally high percentage of rock while it was being filled; but after the mining was finished, the loaders encountered a high percentage of spalls in cleaning out. Furthermore, the method of leaving ribs between stopes did not give over 65 or 70 per cent extraction.

In the course of several years the open quarry reached the property limits and the entire production was demanded from the mine. As yet, the rock supply was not remote from the kilns, and mule haulage was economical and otherwise satisfactory. Track maintenance was not excessive with mule haulage. In 1924, however, work had progressed so far in the mine that it was difficult and dangerous to continue mule haulage.

The headings were 1,100 ft. from the kilns and 400 ft. of this was 4 per cent down grade. For this reason, two Whitcomb gasoline locomotives were installed, one locomotive being held in reserve for emergencies.

**MINING METHODS MODIFIED TO ADVANTAGE**

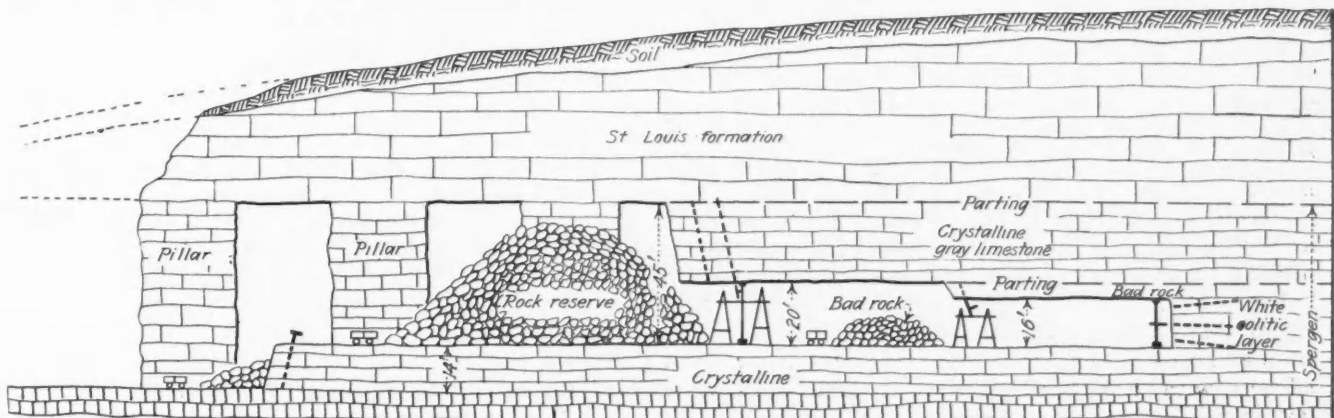
During the last few years mining methods have undergone several changes which have enabled the mine to meet the requirements of the kilns and the peculiarities of the limestone beds. The thickness of the available rock is so great as to suggest shrinkage stopes. This, however, would necessitate a substantial development cost, which lime burning will not carry on a deposit of this thickness. In other words, the beds are not thick enough to justify this cost, but are so thick that special methods must be used to extract economically and safely all the rock in the high stopes. At present the procedure is as follows:

Original headings are driven 40 ft. wide by 16 ft. high, which completely removes a layer of high-grade, oölitic limestone. This stone is loaded and burned separate from the other stone in the mine and yields high-chemical lime. The ground is drilled with wet tappet drills mounted on 16-ft. columns. As many as fifteen holes (about 300 tons) are drilled from one set-up, but the average is about nine holes. Holes range from 15 ft. to 20 ft. in depth and are drilled horizontally in rows of three—a top, middle, and bottom. A special firing order and program of loading is used, which has helped to reduce the percentage of spall.

Water for drilling is furnished under pressure in all headings from the power-house pump. Drilling, loading, and shooting must all be co-ordinated, for these operations must proceed simultaneously in all headings. A year from now it may be possible to do the blasting at night, for by that time additional working places will be available from a new tract of ground being opened up. If the work is not planned properly, one heading may be full of broken rock, with no holes and no place to set up a drill, and another heading may have no broken stone and no holes.

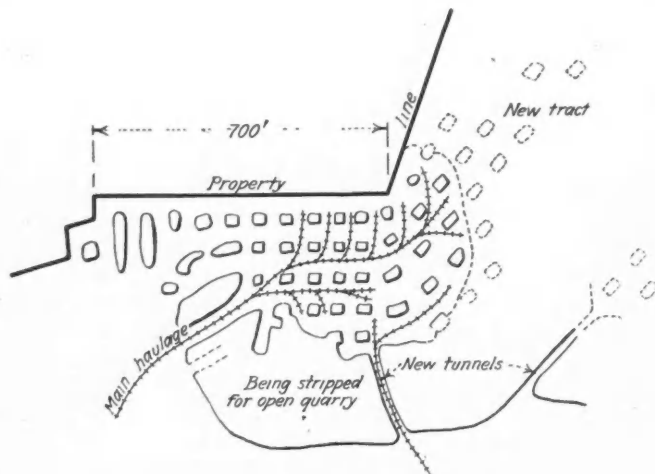
**INFERIOR ROCK KEPT SEPARATE**

Immediately overlying the oölitic limestone is an inferior, off-color layer from 1 to 3 ft. thick. This is taken down with stopers or mounted machines, to a parting which furnishes a cheap, safe roof. It is cheap because, if properly drilled and shot, it requires no further labor for trimming or scaling. The off-color rock is shot down on the tracks which were laid for



Sketch showing present method of mining limestone used by Peerless White Lime Co.





Layout of pillars in mine

removing the rock from the original headings and it is entirely removed from the room. In this manner the bad rock is kept separate from the good.

The removal of the bad rock leaves an empty gallery 40 ft. wide by 20 ft. high. There is an excellent parting 25 ft. above this roof or 45 ft. above the heading floor, and the mining of this block helps reduce mining costs. It is brought down by stoping with a dry drill mounted on an 18-ft. column drilling 21-ft. and 24-ft. holes. Nominally, five such holes is a round and brings down a block which measures 25x40x9 ft., or 750 tons. This fills the gallery to within 8 or 10 ft. of the roof and makes it very handy to inspect and trim the roof if necessary. The principal trouble with this roof is caused by mud cracks. There is only 30 to 40 ft. of overlying rock, and the roof, although solid, is occasionally cut by large cracks of this sort. The larger pockets are given a "dental filling" by means of expan-

sion bolts in the roof, two pieces of old rail, and a few planks. This prevents mud and gravel from falling during rainy seasons.

The large pile of rock in these galleries is also shot down on the original tracks, which are thereby used three times in one position. The tracks are carefully covered with rock before blasting, but the mining system is such that very little rock has to be handled for this purpose, because the rock is shot onto the pile and allowed to roll down on the track instead of dropping directly onto it. This pile is the main rock reserve and is maintained fairly large.

The sides of the pillars are carefully trimmed as the large pile is worked down, for work is yet to be done in these stopes. There is 14 ft. of rock to be removed from the floor, which is done by benching with jackhammers. When completed it leaves a stope about 60 ft. high. With the present spacing of pillars, 86 per cent of the rock is removed. As yet, no attempt has been made to rob any pillars, because no part of the mine is ready. It has not been determined whether it will be advisable to do this later. Four Denver rock drills of the Dreadnaught type are at present in constant use.

Recent developments include the driving of a new entry, which will provide a new and short outlet of the rock in the headings to two larger production kilns which will be in operation soon; also, the driving of two additional tunnels for tapping a new tract of land. The average daily production in the mine for 1925 so far is 450 tons, including rock sold for commercial purposes, and with the new kilns in operation will probably reach 650 tons. Hydraulic stripping is now in progress on the lower portion of the new tract of ground, and it is expected that during 1926 the mine production will be supplemented by an open quarry.

### Blue Asbestos a Good Heat Insulator

The ideal boiler and pipe covering does not exist, since an unusual number of very different properties would require to be combined in the one material, says the *South African Journal of Industries*. Thus a good covering has not only to be a thoroughly efficient non-conductor of heat, but must be able to retain its cellular or other physical structure indefinitely under constant contact with the hot pipe or boiler plate, an extremely difficult matter. Also, it must be mechanically strong so as to remain in one position on the pipe under the influence of vibration and accidental external damage, and it must not be blown out of flange boxes when a joint leaks; further, it should have a low specific gravity so as not to place an undue weight on a long range of pipes.

*Chemistry and Industry*, the journal of the Society of Chemical Industry, observes that one material which is now coming into favor as a covering of a very high-grade character is blue asbestos, which has always found extensive use for locomotive work in the form of mattresses under the outer burnished metal cover.

Blue asbestos or crocidolite, which occurs only in South Africa, contains a considerable proportion of iron, and seems to be a complex ferrous and magnesium silicate with low moisture-content, and of a deep lavender blue in color. It possesses many advantages compared with the ordinary white varieties, the fibres being longer, averaging  $\frac{1}{2}$  to 2 in., with a considerably

higher tensile strength, and it has a lower specific gravity and is much more resistant to high temperatures. As shown by the National Physical Laboratory tests, blue asbestos is one of the best practical non-conductors of heat, being about 20 per cent better than white.

### Mines But No Mining

Many mining districts in the United States are inactive not because the ore is gone but because lower costs or higher prices for the product are necessary for economic operation. Such, for example, is the Low Divide district in Del Norte County, Calif., about which the California State Mining Bureau says:

"The vicissitudes of mining are vividly brought to mind by a visit to the Low Divide district, now deserted (except for one resident, Frank Zaar), and it is difficult to avoid 'romancing' when one realizes that over the same road on which five-ton auto trucks transported chrome ore in 1917-1918 'to save democracy,' wagon loads of high-grade copper ore were being hauled out during the Civil War in 1863-64, bound for Swansea and Germany. The once lively copper camp at Altaville, with several hundred inhabitants and some substantial buildings, has completely disappeared, but the mines are still there, and the recent abrupt ending of chrome mining and the cessation of copper mining at an earlier day have this basis in common: neither operation ceased on account of the mines being worked out. Economic conditions alone have ended mining there for the present.

## Flexibility in Mill Design

*Value of Having Independent Units, Duplication of Major Machines and Adequate and Intermediate Storage*

By Frederick T. Rubidge

Mining Engineer, New York City



Frederick T. Rubidge

**F**LEXIBILITY as applied to milling operations is susceptible of two meanings, one being the adaptability of the plant to turn out varying grades of products, as desired, and the other its adaptability to continue operating notwithstanding the temporary shutdown of one or more of the machines. Reference is made to the latter. The ability to "keep the wheels turning" often spells the differ-

ence between success and failure in mining operations where milling is a necessary adjunct, and the avoidance of conditions which may lead to shutdowns is of the greatest importance. Thus, the removal of tramp iron by means of electro-magnets and automatic feeding mechanisms to prevent overloading, automatic overload alarms, and many other ingenious devices have found their way into present-day mill design.

Keeping the wheels turning also involves such features of structural design as will minimize the duration of shutdowns, and it involves also efficiency in the making of repairs. In this connection I recall an instance where one of the large mills adopted a plan of having a repair gang whose sole duty was the making of repairs. This gang was equipped with all necessary tools, chain-hoists, and other needed apparatus and was stationed in regular quarters much as a fire department would be. When a breakdown occurred in the mill, a gong would be sounded summoning the repair gang. They would all rush to the scene of the breakdown, effect the repairs, and then return to their quarters to await the next signal. This was many years ago, and the design of the mill may have

been such that the whole mill would have to be shut down if any part broke down, in which case the plan may have been a wise one, even though appearing ridiculous.

It is obviously better to so design a mill that it is not subject to frequent shutdowns than to guard against their excessive duration. In accomplishing this objective, *flexibility* is the main consideration. The first step, if the capacity warrants it, is to divide the mill into two or more independent units. Still further flexibility is obtained by duplicating the major machines so that either may be shunted out of the flow and shut down for repairs without affecting the rest of the mill.

Adequate storage bins add greatly to the flexibility of a mill. It is quite common to divide a crushing plant into rough- and fine-crushing departments and to provide large storage ahead of each department so either may be operated independently. Intermediate storage, as for instance between successive rolls where stage reduction is employed, is not often used, but I have observed its great benefit in the slate crushing and screening plants which produce the "granules" for coating asphalt shingles and roll roofing. Such intermediate storage enables the operator to shut down temporarily any set of rolls without shutting down all the rolls, and it also gives opportunity to adjust roll openings (by observing the gain or loss in the storage bins) so that maximum output is obtained.

It is of advantage in a two-unit mill to arrange for cross-feeding between the units at different points. In a recent design for a rock-crushing, screening, and washing plant I was able to effect cross-feeding by gravity at three points. This, in conjunction with intermediate bin storage, resulted in a high degree of flexibility.

Intermediate bin storage need not be of large capacity to accomplish the desired result. I have constructed such bins very economically by using the crib type of construction which permits of a minimum bottom width and the stepping out of the sides so as to obtain increased width as the height increases. Joplin jig construction suggested this advantageous idea to me.

### BUTTE

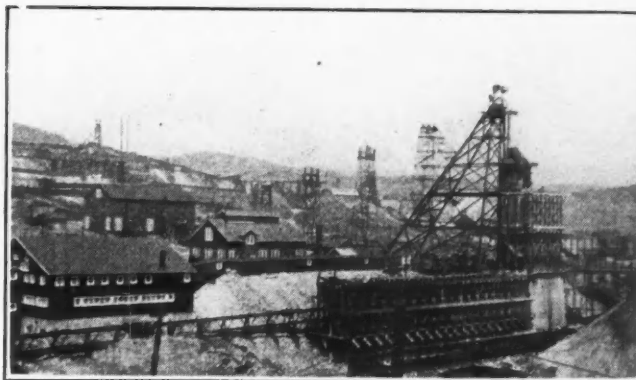
O! Gaunt scarred buttress of the great divide,  
Bereft of trees that once adorned your slopes,  
Heaped high with piles of dross on every side,  
Evisceration of a thousand stopes.

What cyclopean power your substance rends,  
Deep delving in primeval adamant?  
What race of giants here with Earth contends,  
To wrest from her a meed of metal scant?

Not heeding Gods, Olympian hills they bore;  
All nonchalant they smite the rock, and know,  
That Hercules with his great club, nor Thor,  
Could never have delivered such a blow.

Heroic myths were themes of ancient lays;  
But who will sing the deeds of modern days?

A. C. L.



A Butte mine plant—the Granite Mountain



## A Chilean Gold-Panning Operation

*Commercial Results Obtained by Judicious Use of Local Methods—Shovel, Hoe and Rake, Together With the Batea, Are the Implements Employed*

By Lester W. Strauss

Mining Engineer, Valparaiso, Chile

CHILE is best known for its nitrate and copper production, although in years gone by silver and gold were the more important metals produced. Save for the gold shipped as furnace products and minerals, there are at present no extensive activities in the production of the metal. In connection with the development of a dredging enterprise, the following notes on the washing of the pit samples show the advantages of advisedly



Fig. 1—Canal into which gravel from pits is first shoveled. The coarser material is removed with a rake

applying local methods so as to obtain commercial results.

The auriferous ground is situated about 25 miles "inside" from the port of Valparaiso and is readily accessible by automobile. As to topography and climate, the region resembles the well-known Oroville and Marysville districts of California. To check the prospecting done with the Empire drill, pits have been sunk, the gold-bearing material extracted being treated as follows:

Drag scrapers are used to transport the "dirt" to the



Fig. 2—As the water flows through the canal the remaining fine gravel is gently stirred with the feet



Fig. 3—After the sand is ready for panning, the operator lessens the inflow of water and begins to dig out sand accumulated, near the head of the canal

nearest point where water is available, the material being shoveled into a roughly constructed canal (Fig. 1) which is about 20 ft. long and 2 ft. wide (with a wider flare at the "head"), the bottom being the natural creek bed. The head of the canal is supplied with water from the "fore bay," which permits a quiet flow during the period in which the larger gravel is raked out (as seen in Fig. 1) by the use of the common garden rake. This washing is kept up until all the pit material has been treated and only the finer material is left. The water is now reduced in quantity while the fine gravel is gently stirred with the feet as is shown in Fig. 2 (the "man with the hoe"). The operator, being satisfied



Fig. 4—Final washing is done by panning with a batea

that the "sand" is now ready for panning, lessens the inflow of water and begins to dig out the "sand" accumulated, near the head of the canal, as seen in Fig. 3. Final washing is done as shown in Fig. 4, and the resultant panning is seen in Fig. 5 (the arrow indicates the cleanup).

The "batea" used bears a close resemblance to that employed by the Chinese in the Malayan tin operations and is not unsimilar to that used in Nigerian tin washings; in Fig. 5 the short handle of the batea is hidden under the operator's right hand. The batea is approximately 2 ft. in diameter and is conical in form.

The fine gold is recovered by washing the sands in the upper half of the canal, the sands below this section being barren. In Fig. 3 the right half shows the coarse gravel washed, and behind the point where this operation is being performed, but lower down, is the sand dump, which is removed from time to time, so as to facilitate washing.



The gold recovered to date is over 900 fine. Dependent upon the character of the material, the time required to wash and pan is a variable quantity. A sample of 1.5 cu.yd. of sand, overlying the paystreak and comparatively free from gravel, was washed in one and a half hours, while 4.5 cu.yd. of paystreak with con-



Fig. 5—The result of the panning. The arrow indicates the cleanup

siderable coarse gravel took one and a half days or approximately ten working hours, in which considerable time was spent in making the cleanup. Because of frost in May and June, it was impracticable to start earlier than 8:30 a.m. The water from the pits is handled through a portable gasoline-driven pump.

### Mining Equipment Exhibited in Bucharest

Bucharest, Rumania, was recently the scene of a three-day international congress of drilling and mining technologists in conjunction with which an exhibition of equipment and supplies by the manufacturers of many countries was held, according to *Commerce Reports*. An impressive feature of the exhibition was the large display made by the German and Austrian manufacturers of mining equipment and supplies. American manufacturers were represented by only three companies, two of these having only stands for distribution of literature. This lack of representation of American equipment is believed to have been in great measure due to the failure on the part of the committee of organization to bring the exhibition properly to the attention of American manufacturers and in giving prospective American exhibitors insufficient time to get their materials to Bucharest. Though this may be true, it also suggests a lack of interest on the part of American manufacturers. The greater part of the expense of the congress and exhibition was borne by the native oil companies.

### Map of Goudreau District Published

A geological map of a section of country lying to the west of Missinaibi, in the Algoma district of Ontario, Canada, has been published. It covers an area of 450 square miles between the Algoma Central and Canadian Pacific railways and includes a part of the Goudreau mining district. Copies may be had by applying to the Canadian Geological Survey, Ottawa, Canada.

## Possibilities of Shale Oil

*Inquiry Into Recovery, Prices, and Costs Makes It Seem Unlikely That Extensive Industry Can Be Built Up in Near Future on Basis of Present Reserves*

By S. F. Shaw

Mining Engineer, 301 Terrell Road, San Antonio, Tex.

THE AMERICAN PETROLEUM INSTITUTE, through the Committee of Eleven, has recently formulated a report on the supply and demand of petroleum in the United States, which has been submitted to the Federal Oil Conservation Board appointed by President Coolidge. Henry L. Doherty, whose criticisms of the petroleum industry regarding waste are thought to have been partly instrumental in causing this board to be appointed, has also criticized the report of the Committee of Eleven, both as regards the estimate of oil reserves that may yet be recovered from the oil sands and the quantity of oil that may be recovered from oil shales. The report of the committee, as I understand it, does not assume that the total oil existing in the sands and in the shales can be recovered profitably at this time with oil at present prices. It is well recognized that enormous quantities of oil are left in the sands, under present methods, after the fields are abandoned, and it is probable that these reserves will be partly or largely recovered by mining or other methods when the price of petroleum justifies the expense of the recovery. This is parallel to the conditions in many metal mining districts, where the richer deposits are first extracted, followed by extraction of the lower-grade, or less easily won, ore, when metal prices have increased sufficiently to justify the increased mining costs. It is probable that the methods at present employed in mining petroleum can be much improved, resulting in the recovery of a considerably greater proportion of the oil than is now being obtained, at perhaps no greater cost, or possibly at even less expense; that is the problem now being considered by oil operators.

Mr. Doherty has proposed a plan which could probably be made to restrict the production of oil, in that a better control is maintained of the quantity of oil being produced, but this plan does not, as I understand it, result in greater recovery of the oil from the sands.

The use of oil shales to augment the supply of crude oil in the United States will probably be deferred to some future time, and in the case of war in the near future this supply cannot be depended upon to aid to any material extent. The time element enters the problem to a great extent. To open up a large shale mine, build an extensive plant of retorts and a refinery for treating the crude shale oil, and get the enterprise well under way would probably require several years—perhaps three to five years. A retorting plant and refinery could probably be built in from six months to a year, but the development of a mine to a point where large production can be depended upon requires a great deal of time.

It is unfortunate that the oil-shale industry is not getting a good start long before the extensive deposits of easily recovered petroleum are partly or wholly exhausted, but if we consider the results of the work that is being done in Scotland in the mining and treatment of oil shale at the present time we will understand the difficulties that must be faced. The fact that more than 100,000,000 tons of oil shale has been mined

and treated in Scotland gives considerable value to the work that has been done there. The equipment and development of a mine that will produce 1,000 tons of shale per day would probably cost \$1,000,000, not including the interest on expenditures being made on this work up to the time the mine is ready to begin production. The building of a retort plant for handling 1,000 tons of shale per day is estimated by Martin G. Gavin (U. S. Bureau of Mines Bulletin 210, page 91) to cost \$2,190,000. Assuming that the shale would yield one barrel of crude oil of 42 gal., a refinery would be necessary to refine 1,000 bbl. per day and would cost about \$1,000,000 (Bulletin 210, page 91). The total expenditure before any income at all could be expected would therefore be approximately \$4,000,000. It would not be difficult to go into the market and purchase an oil property producing 3,000 bbl. of oil per day, and provided with a refinery and pipe lines for treating 3,000 bbl. per day, for this sum. But let us suppose that all this work has been done and that the mine is fully equipped and developed, and the retorting plant and refinery also completed and operating: what would be the probable operating results of the condition assumed?

STEAM-SHOVEL METHODS NOT  
USUALLY APPLICABLE

As a rule, oil-shale deposits are nearly horizontal and lie under overburden to such an extent that steam-shovel methods can seldom be employed. This means that the mining methods will probably be similar to those employed in coal mines (Bulletin 210, page 111) and that costs will probably be nearly the same as for coal mining. During a period of about one year ending in 1918, the average cost of mining 74,000,000 tons of bituminous coal in the United States was \$1.70 per ton (Shurick, "Coal Mining Costs," page 1). The oil-shale industry could hardly hope to operate at a lower cost per ton than is possible for the coal-mining industry, at least with labor wages at the present level, since labor makes up 70 to 80 per cent of mining costs.

The cost of retorting the oil shale in Scotland is approximately 36 per cent that of mining. Hence it would be about \$0.60 per ton, on a basis of \$1.70 per ton for mining. The total operating cost per barrel of crude shale oil would then be approximately \$2.30, assuming that the oil shale was sufficiently rich to yield one barrel of oil per ton of shale. Compare this cost with the operating cost of extracting a barrel of oil. (U. S. Bureau of Mines, Bulletin 234, "Surface Machinery and Methods for Oil-Well Pumping," by H. C. George, page 138.) Refining of the crude shale oil in Scotland, on the basis of 25 gal. of crude oil per ton of shale, yields the following products:

Shale gas, 9,800 cu.ft. per ton of shale, obtained in the retorts. Employed as fuel in the retort furnaces.  
Shale oil, having the following constituents per ton of shale, when refined:

Naphtha (450 deg. F. end point), gal. ....	2.45
Burning oil, gal. ....	6.13
Gas and fuel oils, gal. ....	5.88
Lubricating oil, gal. ....	1.72
Wax, lb. ....	17.70
Coke, lb. ....	3.62

Ammonia water is produced in the retorts to the amount of 35.7 lb. per ton of shale, expressed in terms of equivalent ammonium sulphate. The shale gas is composed of the gases shown in the table at the top of the next column.

The gas is used in the retort furnaces. It is probable that in the United States this gas would not be of much

	Per Cent
Carbon dioxide .....	20.00
Carbon monoxide .....	4.28
Hydrogen .....	34.21
Methane .....	10.80
Olefines .....	3.06
Oxygen .....	5.10
Nitrogen .....	22.55

Total.....100.00

value other than as a fuel at the base of operations.

The value of the oil products resulting from refining the shale oil on a basis of 1 bbl. of crude oil recovered per ton of shale would be approximately as follows:

Naphtha, 4.2 gal. at \$0.08 per gallon.....	\$0.420
Burning oil, 10.5 gal. at \$0.05 per gal.....	.525
Gas and fuel oils, 10.08 gal. at \$0.03 per gal..	.302
Lubricating stock, 2.94 gal. at \$0.20 per gal..	.588
Wax, 31.1 lb. at \$0.05 per lb.....	1.555
Coke, 6.2 lb. ....	.....

Total.....\$3.370

It is difficult to say what would be the price of ammonium sulphate produced in very large quantities at a distant point from place of production, but assuming that 35 lb. would be recovered from one ton of shale, which could be sold at \$1 per 100 lb., an additional \$0.35 could be added to the value of the refined products, making a total revenue of \$3.72 per ton of oil shale.

The costs would be approximately as follows:

Mining, per ton .....	\$1.70
Retorting, per ton .....	0.60
Refining, per bbl. ....	0.50
Interest on investment at 6 per cent.....	0.66
Depreciation, say basis of twenty years.....	0.55

Total cost.....\$4.01

On the above basis there would be a loss of \$0.29 per ton. Therefore, unless the operator had shale that would yield more than 42 gal. of crude oil per ton, or could reduce costs below the figures assumed, or received a higher price for the products than those assumed, he would find no encouragement in undertaking the venture.

The report of the Committee of Eleven gives the following figures for crude shale oil that might be expected as recoverable from the oil-shale reserves of the United States ("American Petroleum; Supply and Demand," page 135):

State	Tons of Oil Shale	Gallons Crude Oil per Ton Shale	Total Barrels Recoverable of Crude Oil
California...	13,939,200,000	20	5,575,689,000
Colorado....	113,792,000,000	15	40,640,000,000
Indiana.....	69,696,000,000	10	13,939,200,000
Kentucky....	90,604,800,000	16	28,993,536,000
Montana....	6,969,600,000	10	1,393,920,000
Nevada.....	7,219,000	15	2,165,000
Utah.....	92,159,000,000	15	16,588,620,000
Wyoming...	7,176,000,000	15	1,291,680,000
Total.....	394,343,819,000		108,424,801,000

The estimates herewith given indicate an average recovery of 0.275 bbl., or 11.5 gal. per ton of oil shale. As the economic outcome is in doubt where a recovery of 42 gal. per ton of oil shale is assumed, it does not appear likely that an extensive industry can be built up in the near future on a basis of the reserves of oil shale now supposed to exist in the United States.



# Australia—the Infant in the Iron Industry\*

*Estimated Known Reserves of Ore About 450,000,000 Tons; Probable Tonnage Much Larger—  
Found Distributed in All States, Including Tasmania and Excepting Northern  
Territory, Which Is Practically Unexplored*

By **Olin R. Kuhn**  
Donner Steel Co., Buffalo, N. Y.

**A**USTRALIA, the farthest outpost of the British Empire, is of about the same size as the United States of America in area. This vast country is practically a new one, and a great portion of it is still unexplored and undeveloped. The entire continent is divided into seven large states: Western Australia, Northern Territory, South Australia, Queensland, New South Wales, Victoria, and Tasmania. Iron ore has been found in all of these states with the exception of the Northern Territory, which is a vast practically unexplored area, although ore will probably be found there. Tasmania, although it is an island separated from Australia, is usually included as part of the continent. The following tabulation affords an interesting comparison:

	Australia	United States
Area (square miles) .....	2,974,581	3,026,791
Population (approximate) .....	5,500,000	110,000,000
Number of blast furnaces .....	6	450
Record pig iron production (1921) .....	358,000	(1923) 40,025,850
Iron-ore reserves .....	919,800,000	10,500,000,000

Records show that before the arrival of the Europeans in Australia, iron was unknown. The first record of an attempt to manufacture it was in a furnace at Mittagong, New South Wales, in 1848, but this venture was not successful. From then until 1908 several endeavors were made to establish an iron industry, but all failed. In 1908, the Hoskins Iron & Steel Co., Ltd., purchased the old Lithgow Iron Works at Lithgow, New South Wales, and erected a modern plant. This company was followed in 1911 by the Broken Hill Proprietary Co., Ltd., which erected blast furnaces and a steel plant at Newcastle, New South Wales. These are the only two plants at present in Australia. The Hoskins Iron & Steel Co. has planned to build another plant at Port Kembla, and the Queensland Government expects to erect an iron and steel plant in the near future at Bowen, but this work has been held up on account of the depression following the World War. Many other associated industries have developed such as sheet, pipe, wire, and nail works. The following list of attempts to establish an iron industry in Australia were all unsuccessful except the Hoskins and Broken Hill companies.

### Development of the Iron Industry in Australia

- 1848. Furnace at Mittagong, New South Wales.
- 1852. Fitzroy Iron Works erected near Sydney, New South Wales.
- 1859. Fitzroy Iron Works leased by Latton & Hughes.
- 1872. British & Tasmania Charcoal Co. furnace at Beaconsfield, Tasmania.

\*Much of the information contained in this compilation was obtained from the following sources: "Development of the Iron and Steel Industry in Australia," by David Baker, general manager, Broken Hill Proprietary Co., Australia, a paper presented before the American Iron and Steel Institute in 1922; also from Bulletin No. 9 of the Geological Survey of South Australia, "The Iron Ore Resources of South Australia," by R. L. Jack, 1922; and from the bulletin on "Iron Ore in Australia and New Zealand," by the Imperial Mineral Resources Bureau, London, 1922.

- 1873. Furnace at Mount Jagger, South Australia.
- 1874. Lithgow Iron Works at Lithgow, New South Wales.
- 1875. Furnace at Lal Lal, near Ballarat, Victoria.  
Fitzroy Iron Works sold to Fitzroy Bessemer Steel & Coal Co.
- 1885. Lithgow Iron Works leased to William Sanford.
- 1908. Lithgow Iron Works sold to Hoskins Iron & Steel Co., Ltd., which enlarged the plant.
- 1914. Broken Hill Proprietary Co., Ltd., entered the iron and steel field and erected a plant at Newcastle, New South Wales.
- 1920. The Queensland Government planned to erect a furnace and steel plant at Bowen.
- 1921. The Hoskins Iron & Steel Co. planned to erect a new plant at Port Kembla.



Sketch map of Australia, showing location of important deposits of iron ore

The Hoskins Iron & Steel Co. and the Broken Hill Proprietary Co. have a total pig-iron capacity of about 700,000 tons annually, as given in the accompanying table.

	Hoskins Iron & Steel Co.	Broken Hill Proprietary Co.
Located at .....	Lithgow	Newcastle
Blast furnaces .....	2	4
Capacity of furnaces, tons .....	160,000	540,000
Coke ovens .....	190 Belgians	224 Smet Solvay (Plan 66 additional)
Open-hearth furnaces .....	4	7 (Plan enlarging)
Blooming mill .....	28 in.	35 in. (Plan 40 in. mill)
Rail mill .....		28 in.
Merchant mills .....	18 in.-10 in. 9 in.	18 in.-12 in.-8 in.
Rod mill .....		1

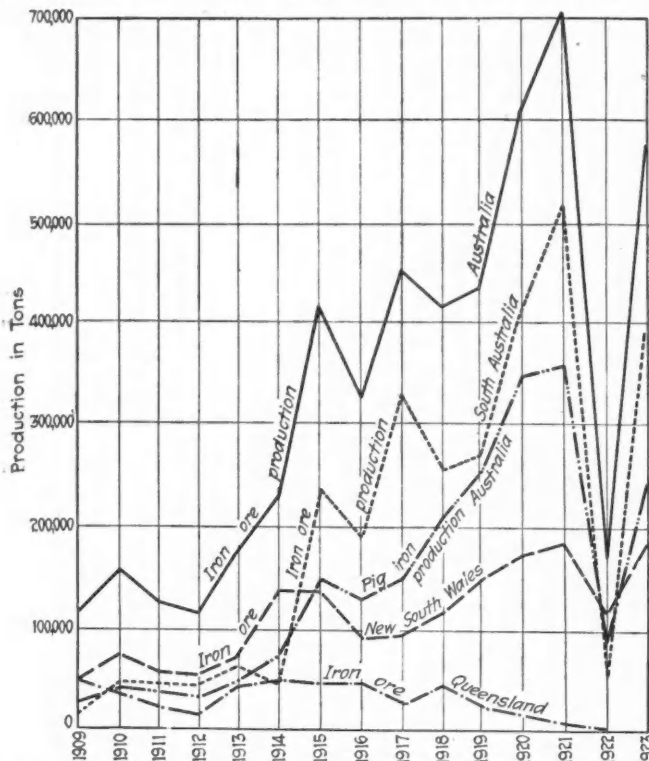
The Hoskins furnaces use ore from Tallawang, Carcoar, and Cadia in New South Wales, and the Newcastle furnaces ores from the Iron Knob and Iron Monarch deposits in South Australia and get their limestone from Tasmania. Both plants use coke made from coal from the near-by New South Wales coal fields.

Although the iron ore and pig-iron production of Australia has never been very large, on account of the present requirements, it is steadily increasing and the time is not far away when Australia will be mining



over 1,000,000 tons of iron ore and producing more than 500,000 tons of pig iron annually.

Practically no iron is exported or imported into Australia. Pig-iron imports have never been more than 65,000 tons in one year, and in recent years they have



Graphs of iron ore and pig iron production in Australia 1909-1923

not been large enough to consider. Exports of iron have been small until 1920, when over 19,000 tons were shipped, most of it going to Japan.

**Iron-Ore and Pig-Iron Production of Australia**

Year	Iron-Ore Production			Total	Pig-Iron Production
	New South Wales	Queensland	South Australia		
1909	51,100	48,600	16,100	115,800	26,800
1910	74,500	37,100	46,200	157,800	40,500
1911	59,400	20,600	42,300	122,300	36,400
1912	56,300	15,500	42,200	114,000	32,700
1913	71,600	40,800	60,700	173,100	46,600
1914	135,300	48,100	42,600	226,000	75,100
1915	134,700	45,700	237,400	417,800	146,500
1916	91,700	44,200	188,300	324,200	127,600
1917	96,400	25,100	328,400	449,900	148,400
1918	116,500	42,800	257,000	416,300	209,300
1919	144,100	24,700	268,500	437,300	253,800
1920	172,900	19,700	413,000	605,600	344,000
1921	181,800	4,100	515,100	701,000	358,000
1922	115,200	.....	52,200	167,400	84,900
1923	181,300	200	390,600	573,100	239,300

The various states, with the exception of the Northern Territory, have been fairly well explored for iron ore, and several large deposits have been found and developed. Although the iron-ore reserves of Australia are not large when compared with those of the United States or Europe, still they are of sufficient size to supply the requirements of the Commonwealth for a considerable period, but they cannot be looked upon as a supply for other parts of the world. Assuming that the iron-ore production doubles every twenty years, the known and probable reserve will last about 110 years. At the present rate of mining, about 500,000 tons annually, it would not be exhausted for over 1,800 years. The accompanying graphs give the iron-ore and pig-iron production of the various states of Australia from 1909 to 1923.

Although not yet a producer, Western Australia

probably contains one of the largest reserves of iron ore known in Australia. The absence of coal fields in this district has probably held up somewhat the development of the state. The largest known deposits are those of Koolan and Cockatoo Islands, in Yampi Sound, in the northern part of the state, about 100 miles north of Derby. Yampi Sound is an almost entirely land-locked harbor of large extent with good deep-water entrances between the islands. On both Koolan and Cockatoo islands the ore deposits are in the form of dense, solid, steel-gray, crystalline hematite of micaceous structure, interbedded with quartzites and clay slates. They were originally beds of sedimentary origin, but through the changes that have affected them, they have in many places the characteristics of lodes. They come to the surface, however, as thick beds dipping at angles of from 50 to 55 deg. Both islands contain two main groups, the northern and the southern, and in each case the southern zone is by far the more important for immediate production, for the ore beds have been uncovered over large areas by the natural erosion of the strata overlying them. Much of the ore in these beds can be mined by quarrying without the removal of overburden.

On Koolan Island the southern orebody outcrop forms the crest of a ridge along the southern end of the island rising to a height of 600 ft. and can be followed for over 2½ miles. The width of the orebody is about 140 ft. and it is about 100 ft. thick. The northern orebody contains a large quantity of high-grade ore, but there is also a large portion of it that is of inferior quality, being very siliceous.

On Cockatoo Island the northern group of ore beds lies a short distance west of the end of the southern orebody and contains three or four parallel beds of ore, although only one of them is of sufficient size and grade to be mined commercially.

The beds on both Koolan and Cockatoo islands extend under the sea at both ends, so that the estimates of reserves given below are probably very conservative. Montgomery estimates the quantity of ore available in these deposits above high water to be as in the table given.

**Iron-Ore Reserves—Koolan and Cockatoo Islands**

		Tons
Koolan Island	—Southern orebody.....	68,850,000
	Northern orebody.....	7,700,000
Total reserves.....		76,550,000
Cockatoo Island	—Southern orebody.....	13,850,000
	Northern orebody.....	6,900,000
Total reserves.....		20,750,000

The Imperial Mineral Resources Bureau of London credits Koolan Island with a probable reserve of 350,000,000 tons additional and Cockatoo Island with 100,000,000 tons.

The ore is generally high grade and low in phosphorus and sulphur, although that in the northern beds is considerably higher in silica than that in the southern or main beds. The Queensland Government has purchased the deposits on Cockatoo Island and it is the government's intention to ship the ore to its plant at Bowen, where it will be mixed with ore from Cloncurry.

**Yampi Sound Iron Ores**

	—Koolan Island—		—Cockatoo Island—	
	Southern	Northern	Southern	Northern
Iron, per cent.....	66.48	56.91	68.99	51.70
Silica, per cent.....	4.16	4.20	.95	25.55
Sulphur, per cent.....	.07	.06	.01	.05
Phosphorous, per cent.....	.062	.014	.008	.01

Iron ores occur at Pilbara, near the northeastern coast of Western Australia, and near Glen Roebourne. The ore is a micaceous hematite, and the largest deposit is about half a mile long by 50 ft. wide. This body of ore has never been worked except for a flux when copper was smelted at Mons Cupri.

At Mount Stuart, on the Ashburton River, a banded hematite quartzite occurs which could readily be concentrated into a high-grade ore. An analysis taken by the Geological Survey Laboratory gave silica 40.21 per cent and iron 38.80 per cent. Mount Edith, some miles south of Mount Stuart, consists of banded iron-bearing quartzite associated with sandstone. The ore is, as a rule, hematite and of higher grade than that found at Mount Stuart.

In the Murchison district, in the west-central part of the state, ore is found in the range of hills including Mounts Taylor, Hale, Matthews, and Narryer, but little is known of the amount of the ore that they contain except that it is considerable. The ore is mainly hematite, although some limonite and magnetite are also present, and it carries from 82 to 97 per cent of ferric oxide and from 1 to 9 per cent of silica. The Wilgie Mia deposit lies just south of the above-named range of hills and is on the south side of the Weld Range. The ore here is nearly pure hematite and carries from 64 to 69 per cent of iron and from 1 to 2.5 per cent of silica. This lode has a length of about four miles and a width of 150 ft., and has been opened to a depth of about 100 ft. This orebody has also been explored to a depth of 250 ft. and shows about 26,500,000 tons of ore in sight above the level of the plain.

At Gabanintha, east of Nannine, there is a low ridge consisting of hematite and magnetite ore which averages 52.14 per cent in iron and very low in silica, phosphorus and sulphur, but which contains about 13 per cent of titanitic acid. The orebody is from 50 to 100 ft. wide and rises in places from 50 to 60 ft. above the surrounding plain. It is estimated that there is about 1,500,000 tons of ore in this deposit above the level of the plain.

In the neighborhood of Edjudina, in the southeastern part of the state, there is a belt of hematite and quartzite which carries from 35 to 55 per cent of ferric oxide and from 40 to 60 per cent of silica. On account of the low grade of the ore, little attention has been paid to this deposit.

Mount Gibson is situated in the Yalgoo gold field, and consists of quartz-hematite-schist in which the iron oxide alternates with jaspilite and some other minerals. The main orebody is a large lens 2,000 ft. long and averaging 200 ft. in width, rising to a height of 300 ft. above the surrounding country. The ore varies from quartzite to almost pure hematite, and Gibb Maitland estimates that at least 10,000,000 tons of ore is available in this deposit.

#### GOETHITE IN THE YILGARN DISTRICT

In the Yilgarn gold field, ironstone lodes occur along the contact of metamorphic with igneous rocks, the most notable of which is Mount Caudan. Here the lode consists of goethite associated with subsidiary deposits of magnetite and siderite. This orebody has been drilled to between 500 and 750 ft., and it was found to consist of a considerable thickness of siderite and magnetite as well as a solid mass of pyrrhotite, while the outcrop of the lode is goethite. The goethite

averages from 50 to 60 per cent in iron, 2 to 4 per cent in silica, and up to 8 per cent in manganese. The siderite runs from 39 to 44 per cent in iron and from 3 to 12 per cent in silica, and the magnetite carries about 43 per cent of iron and 28 per cent of silica. The Mount Caudan orebody is estimated to contain about 20,000,000 tons of known ore, with a possible 20,000,000 tons additional.

Deposits similar to those described above occur in the Koolyanbling area near Kondip, Ravnsthorpe, and Mount Jackson. The ore contains from 60 to 63 per cent of iron, 2 to 5 per cent of silica, and is very low in sulphur and phosphorus. It is estimated that these deposits contain only about 1,000,000 tons of known ore, with a possible 1,000,000 tons additional.

Laterite ores occur in various parts of Western Australia, but they vary greatly in their composition. About 60,000 tons has been produced, most of which was used for fluxing, and although it is stated that there is many millions of tons reserve, no definite data are available. The ores occur principally near Perth, at Waterfall, in Murchison and Central Division, and are usually turgite and limonite varying from 60 to 80 per cent in ferric oxide and from 2 to 10 per cent in silica.

#### Iron Ore Reserves of Western Australia

Deposit	Kind of Ore	Known	Probable	Possible	Per Cent Iron
Koolan Island	Hematite...	76,550,000	350,000,000	.....	67.00
Cockatoo Island	Hematite...	20,750,000	100,000,000	.....	52-69
Wilgie Mia	Hematite...	26,500,000	.....	.....	64-69
Gabanintha	Hematite and Magnetite	1,500,000	.....	.....	52.14
Mount Gibson	Hematite...	10,000,000	.....	.....	28-68
Mounts Taylor and Hale	Hematite...	.....	Large	.....	57-68
Mount Caudan	Goethite...	20,000,000	.....	20,000,000	40-60
Koolyanbling	Goethite...	1,000,000	.....	1,000,000	60-63
Laterite	Laterite...	.....	.....	.....	42-56
Totals	.....	156,300,000	450,000,000	21,000,000	

The reserve of Western Australia, though large and fairly well explored, is still undeveloped and practically no ore has been shipped from the state. The reserves will probably play an important part in the iron industry of Australia in the future.

#### SOUTH AUSTRALIA LARGEST PRODUCER

South Australia is located in the south central part of the country and contains some of the largest known deposits of iron ore in the Commonwealth, the largest of which are those of Iron Knob and Iron Monarch and Iron Prince and Iron Baron. More ore is produced in South Australia than in any other state and most of it is shipped to New South Wales for smelting.

The Iron Knob and Iron Monarch iron ore deposits are in Manchester County, east of Gilles Lake near Spencer Bay. These deposits are owned by the Broken Hill Proprietary Co. at Port Pirie, and the ore is smelted in the company's furnaces at Newcastle, New South Wales.

The Iron Knob was the first orebody to be worked, and is tabular in form, having an outcrop length of over 2,000 ft. and a width of about 150 ft. It is vertically disposed and forms the core of a hog-backed hill. Two quarries have been opened, "C" and "D." Quarry "D" is practically exhausted and "C" is the only one operating at present. The ore is a high-grade hematite, averaging over 68.50 per cent of metallic iron. Quarry "C" is estimated to contain about 2,188,200 tons and quarry "D" only about 300,000 tons.

About half a mile south lies the Iron Monarch deposit, which has only recently been opened. The outcrop



covers about fifty-two acres and is roughly triangular in plan. It is massive, and occupies the central part of a dome-shaped hill, the crest of which rises about 600 ft. above the surrounding plain. Two quarries have been opened in the southeastern and southwestern corners of the Iron Monarch deposit. The former exposure shows a notable proportion of manganese ore in association with the hematite, but the deposit at the latter consists of hematite with only a trace of manganese. The iron content in the Iron Monarch ore will average about 60 per cent, and it is estimated by R. L. Jack that a reserve of about 130,167,380 tons of ore is available here by quarrying methods. There is no doubt that the ore extends to greater depths, but in the absence of development work no estimates of the tonnage can be formed.

Some magnetite ore has been found in the Iron Monarch deposit on Lease 1,662, but the workable depth of the ore is only about 100 ft. and the reserve has been put at about 544,500 tons. Since 1915 practically all of the ore mined from the Iron Knob and Iron Monarch deposits has been shipped to Newcastle for the manufacture of iron and steel.

Several years ago iron ore was discovered in the Middleback Range to the south of Iron Knob, which deposits are known as the Iron Prince and Iron Baron, and they are leased by the Broken Hill Proprietary Co. These deposits are very similar to those of the Iron Knob and Iron Monarch, and the ore is a high-grade hematite carrying from 65 to 68 per cent of iron. These deposits have been prospected, and it is estimated by R. L. Jack that 14,890,000 tons of ore is available for open-cut mining and 17,261,000 tons recoverable underground, or a total of 32,151,000 tons. The chief disability is lack of water, which must be supplied before serious exploitation is possible.

The Mount Bessemer mine, near Williamstown, has produced over 40,000 tons of ore, most of which has been used as flux by the lead smelters. The orebody consists of a specular iron ore, largely micaceous, and constitutes a lode 16 ft. in width, dipping at an angle of 40 deg. The outcrop can be traced for about 2,000 ft. in length and to a depth of 140 ft. It is estimated that this mine contains 535,920 tons of ore available above the creek level that can be mined by open quarrying, but no figures are available of the tonnage below the creek level that will have to be mined underground. The ore is generally hematite averaging from 50 to 55 per cent of metallic iron, but parts of the deposit contain ore over 60 per cent in iron.

#### TITANIFEROUS ORES AT ENCOUNTER BAY AND GOOLWA

The Mount Jagged and Peeralilla mines are located in the County of Hindmarsh, at Encounter Bay and Goolwa, respectively. The Mount Jagged mine has been explored to some extent and the ore found to be hematite and limonite carrying about 65 per cent of iron and 5 per cent of titanite oxide. Owing to the titanium in the ore, and because of the fact that most of the ore would have to be taken out underground, less than 2,000 tons was mined and exploration stopped. No reliable estimates of the reserve tonnage in the Mount Jagged mine are available.

The Peeralilla mine is at an elevation of about 1,000 ft. above sea level, and was worked in two benches. The upper bench shows the ore to have been removed to a depth of from 1 to 8 ft., or to an average depth of

3 ft. The lower or smaller bench contains ore from 2 to 10 ft. in thickness. The ore is a limonite averaging about 49 per cent in iron and 6.6 per cent in silica. Although only about 10,000 tons of ore has been taken from this mine, it is estimated that only 45,000 tons of available ore remains.

The Koolka deposit, near Ironstone Well, consists of two main lenticular masses of magnetic iron ore about half a mile apart. They are at right angles to each other and are not connected. The main or northern deposit is over 700 ft. long, 30 ft. wide, and about 50 ft. high. The ore is hematite containing from 66 to 67 per cent of iron, and it is estimated that 320,000 tons of ore is available above 100 ft. in depth. The southern group consists of a lenticular body 250 ft. in length and 20 ft. wide, and several smaller bodies. The ore is similar to that in the northern orebody, and the reserve is estimated at about 94,000 tons. The total reserve of the Koolka deposits can be put at 414,000 tons of hematite ore averaging over 66 per cent in iron.

Donnelly's quarries are in the County of Newcastle about 14 miles north of Quorm. The orebodies occur on either side of a valley and consist for the most part of limonite with a little hematite. Some high-grade limonite is found, but much of the ore is siliceous and the western orebodies are inclined to be manganiferous. The average for nine samples of ore taken from various parts, excluding the manganiferous ore, showed 49.17 per cent iron, 14.71 per cent silica, and 1.60 per cent phosphoric acid. The different bodies vary from 10 to 30 ft. in depth, and the Imperial Mineral Resources Bureau estimates the known reserve to be about 470,000 tons. At one time a little of this ore was used for flux at Port Pirie, but in recent years none has been quarried.

#### BROWN ORES AT GRANT QUARRIES

The Grant or Cutana quarries are on the Broken Hill Railway, about 190 miles from Port Pirie near the border of New South Wales. The deposits are scattered and consist of brown iron ore and a little hematite. The workings were numerous and extended over a considerable area, but when the ore at Iron Knob became available they were abandoned. The deposits are found in the more elevated portions of the area, and the bodies are from 5 to 22 ft. thick. The ore is inclined to be siliceous, carrying from 43 to 51 per cent iron and 18 to 25 per cent silica. R. L. Jack estimates the probable tonnage in these deposits at 810,000 tons and the Resources Bureau puts it at 1,000,000 tons of possible ore.

The Mingary deposit is close to the Cutana orebody and is now abandoned. There is an old open quarry here which shows the orebody to have averaged about 15 ft. in thickness and to be covered by from 2 to 6 ft. of rubbly marl. The ore is limonite and carries about 57 per cent iron and 11.30 per cent silica. The probable reserve of ore in this deposit is estimated at about 250,000 tons.

The Billeroo deposits are located about 20 miles northwest of the Cutana quarries and contain four orebodies inclosed in schists. The ore is magnetite and hematite but inclined to be siliceous. An average sample from the outcrop of the western or largest deposit showed 50 per cent iron and 26 per cent silica. The reserve of these deposits is estimated at about 385,000 tons of probable ore above the 100-ft. level.

Other deposits of iron ore exist in South Australia, but none of them have yet been considered as likely to



Analyses of Iron Ores of South Australia

	Iron Knob	Iron Monarch	Iron Prince	Grant-Cutana	Mount Bessemer	Mount Jagged	Peeralilla	Koolka
Iron, per cent.....	68.00	53-68	65.72	49.73	60.13	65.30	49.10	65.64
Silica, per cent.....	1.00	0.5-2	0.7-5	4.37	10.43	1.12	6.62	2.24
Sulphur, per cent.....	0.06	0.02-0.07	0.07	0.15	0.02	0.05	0.21	0.06
Phosphorus, per cent.....	0.03	0.04	0.03	0.03	0.03	.....	0.15	0.30
Type of ore.....	Hematite	Hematite	Hematite	Limonite	Hematite	Hematite and Limonite	Limonite	Magnetite

provide the supplies requisite for iron smelting. The table given above contains roughly the analyses of the ores from the various deposits in South Australia.

Iron-Ore Reserves of South Australia

Deposit	Kind of Ore	Known Reserve	Probable Reserve	Possible Reserve	Per Cent Iron
Iron Knob.....	Hematite.....	2,488,200	.....	Large	68.50
Iron Monarch.....	Hematite.....	130,167,380	.....	Large	60.00
Iron Monarch.....	Magnetite.....	544,500	.....	.....	.....
Iron Prince and Iron Baron.....	Hematite.....	32,151,000	.....	.....	65-68
Mt. Bessemer.....	Hematite.....	535,920	.....	.....	50-55
Peeralilla.....	Limonite.....	45,000	.....	.....	49.00
Koolka.....	Magnetite.....	414,000	.....	.....	66.00
Donnelly's.....	Limonite.....	470,000	.....	.....	49.00
Cutana.....	Brown.....	.....	810,000	190,000	43-51
Mingary.....	Limonite.....	.....	250,000	.....	57.00
Billeroo.....	Magnetite and Hematite.....	.....	385,000	.....	50.00
Totals.....	.....	166,816,000	1,445,000	190,000	.....

QUEENSLAND HAS NUMEROUS DEPOSITS

Iron ore is widely distributed throughout Queensland, and some ore has been produced there, although no mines are operating at present. The largest known deposits in Queensland are those of Mounts Philp and Leviathan. Dr. Logan Jack refers to the enormous deposits of limonite and magnetite ores in the Cloncurry district, but he does not state any definite reserve.

Mounts Philp, Pisa, and Leviathan are in the Cloncurry district about 250 miles from the Gulf of Carpentaria. The Mount Leviathan deposit is a large mass of ironstone associated with quartzites, schists, and limestones and is a lens-shaped lode lying obliquely across the upturned edges of the sedimentary rocks. The ore is hematite and a small portion is very pure, but the main mass contains a high percentage of silica. The iron content varies from 56 to 62 per cent and the silica from 9 to 18 per cent, the phosphorus and sulphur being generally low. The reserve of Mount Leviathan is estimated at 2,000,000 tons. Mount Pisa is located about two miles from Mount Leviathan and is estimated to contain about 1,000,000 tons of similar ore.

Mount Philp is 63 miles from Cloncurry and is a series of hills and peaks made up of enormous outcrops of ironstone. The ironstone appears to be very uniform in composition, and the outcrop can be observed for miles, but a length of two miles along the main portion contains all of the measurable quantities of ore, although there are probably other large tonnages more or less obscured. The ore is chiefly hematite with magnetite occasionally present. The silica is always high, from 19 to 23 per cent, but the other impurities appear to be low. The iron content varies from 52 to 57 per cent. The width of the deposit averages about 100 ft. and the height varies from 50 to 500 ft. above the level of the Fountain Creek. It is estimated that the known reserve of ore in the Mount Philp deposit is about 20,000,000 tons, the probable reserve 20,000,000 tons, and the possible reserve another 20,000,000 tons.

Mount Lucy is three miles west of Almaden, and the ironstone of the district appears to be simply a shallow capping to the mount, which is 900 ft. long and has a width of some 250 ft., the height above the surrounding country being 150 ft. The orebody is about 50 ft. thick and contains some 350,000 tons of actual ore in sight. The ore is between a magnetite

and a hematite carrying 54 per cent iron and 1.75 per cent silica.

Iron Island is one of the islands of the Northumberland group off the coast of Queensland. It is about a quarter of a mile long and 500 ft. wide. The highest point of the island is 120 ft. above high-water mark. The orebody covers the greater part of the island, and the ore consists of magnetite with massive hematite carrying about 64 per cent iron and 2 per cent silica. It is estimated that 1,500,000 tons of ore is available in this deposit. At Stanage Point, on the mainland, there is a deposit of hematite ore containing about 60 per cent iron, but the reserve is estimated to be only about 7,000 tons.

Many other scattered deposits of iron ore are found in Queensland, but the reserve in each is small and none of them are worked at present. One of the largest is Olsen's Caves, 14 miles from Rock Lampton, which contains about 250,000 tons of hematite ore carrying from 67 to 73 per cent of iron and practically no phosphorus. The Oakey Lode, near Alma Creek, contains 118,000 tons of hematite and magnetite ore carrying 56 per cent iron and 10.40 per cent silica within 100 ft. of the surface, and the Pleasant Lode near by contains about 250,000 tons of ore averaging 55 per cent iron and from 5 to 12 per cent silica. Limonite ore carrying from 50 to 52 per cent iron and from 9 to 10 per cent silica is found at Pittsworth and Rolliston, but the available reserves are put at only 10,000 and 50,000 tons respectively. The Biggenden deposit, about 160 miles from Brisbane, contains about 140,000 tons of hematite ore carrying about 43 per cent of iron with a probable 60,000 tons additional. The tonnage below the present workings will possibly add 308,000 tons more. Glassford, 60 miles south of Gladstone, contains about 500,000 tons of hematite and magnetite ore available within 200 ft. of the surface. Peter's Nob and Mount Perry contain small deposits of low-grade brown ore carrying about 35 per cent of metallic iron, but the reserve is estimated at only about 100,000 tons in each.

Iron Ore Reserves of Queensland

District	Kind of Ore	Known Reserve	Probable Reserve	Possible Reserve	Per Cent Iron
Mount Leviathan.....	Hematite.....	2,000,000	.....	.....	56-62
Mount Philp.....	Hematite.....	20,000,000	20,000,000	20,000,000	52-57
Mount Pisa.....	Hematite.....	1,000,000	.....	.....	56-62
Mount Lucy.....	Hematite and Magnetite.....	350,000	.....	.....	64.00
Iron Island.....	Hematite and Magnetite.....	1,507,000	.....	.....	64.00
Olsen's Caves.....	Hematite and Magnetite.....	250,000	.....	.....	67-73
Oakey Lode.....	Hematite and Magnetite.....	118,000	.....	.....	56.00
Pleasant Lode.....	Hematite and Magnetite.....	250,000	.....	.....	55.00
Pittsworth.....	Limonite.....	10,000	.....	.....	50-52
Rolliston.....	Limonite.....	50,000	.....	.....	50-52
Biggenden.....	Hematite.....	140,000	60,000	308,000	43.00
Gassford.....	Hematite and Magnetite.....	500,000	.....	.....	.....
Mount Perry.....	Brown.....	100,000	.....	.....	35.00
Peter's Nob.....	Brown.....	100,000	.....	.....	35.00
Totals.....	.....	26,375,000	20,060,000	20,308,000	.....

NEW SOUTH WALES OREBODIES SMALL, CADIA EXCEPTED

A number of iron-ore deposits have been found in New South Wales, but aside from the Cadia deposit they are all fairly small. Most of the deposits of any

importance are in the eastern part of the state. Cadia, the largest deposit, lies about 14 miles west of Orange and consists of a bedded ore which outcrops in two localities about a half mile from each other. The ore-body varies from 60 to 80 ft. in thickness and dips at about 15 deg. The ore is hematite and magnetite, although some carbonate is also found. The largest mines in the district are the Caroblas and the Iron Duke, and the ore varies from 52 to 62 per cent in iron and from 5 to 10 per cent in silica. It is estimated that about 39,000,000 tons of ore is available in the Cadia deposits.

The Carcoar deposits are at Coombling Park about 15 miles from Cadia. The ore is hematite with a little limonite. It is compact and possesses either a brown, reddish brown, or dull purple color. That obtained near the surface is more or less ocherous. All of the ore contains more or less manganese and the iron content varies from 55 to 58 per cent and the silica from 5 to 7.5 per cent. The Hoskins Iron & Steel Co. owns this deposit, and the ore is smelted at Lithgow. It is estimated that about 3,000,000 tons of ore is available in this deposit, most of which can be quarried.

The Mittagong and Wingello deposits contain aluminiferous ore carrying from 20 to 25 per cent iron and from 30 to 37 per cent alumina. The ore is generally limonite, and about 1,500,000 tons of ore is available in these bodies. There are many other small deposits of aluminiferous ore in this district, which probably contain a total of about 3,260,000 tons, but they are not worked at present, on account of their low iron and high silica content.

#### THREE PROMINENT DEPOSITS OF MAGNETITE

Three outstanding deposits of magnetite ore occur in New South Wales at Gulgong, Cowra and Queanbeyan, although magnetite is also found at Cadia, Goulburn, Mudgee, Newbridge, and Wallerawang. In the Gulgong district deposits of magnetite occur in the form of large pockets in crystalline schists. The outcrop forms a low ridge and the ore contains 65.12 per cent iron and 2.58 per cent silica, the other constituents being low. Reserves of the Gulgong district are estimated at about 120,000 tons of available ore. The Cowra district lies at the foot of the Broula Range and the ore is mixed with garnet rock. Reserves of the Broula Range are put at about 100,000 tons of ore averaging 66 per cent iron, 3.20 per cent silica, and very low in sulphur and phosphorus. There is a deposit of magnetite near Queanbeyan, in Beresford County, extending up the side of a hill from the bed of Paddy's River. This deposit contains about 1,000,000 tons of available ore carrying 65 per cent iron, 6 per cent silica, and only a trace of phosphorus and sulphur.

In the Chalybeate Springs district there are about twenty scattered deposits of limonite ore which contain from 1,000 to 250,000 tons. Much of this ore has been used by various gas-producing companies in Sydney, but there is little activity here at present. The reserve is put at 1,510,000 tons of ore averaging 44 to 58 per cent iron.

The Bredalbane deposit, in the Parish of Milbang, contains about 700,000 tons of limonite ore, which can be readily quarried and carries about 60 per cent iron and 5.50 per cent silica. The deposits of Goulburn consist of irregular shaped masses of spongy brown iron ore carrying from 42 to 53 per cent iron and from 3 to

24 per cent silica. It is estimated that the Goulburn deposits contain about 1,022,000 tons of ore in sight. In the Mandurra and Woodstock districts deposits of brown ore occur as pockets in several localities, which average from 52 to 58 per cent iron and from 2 to 8 per cent silica. The reserve in sight is put at about 609,000 tons. An orebody of limonite and hematite occurs in the southwest corner of Marulan parish, which contains about 40,000 tons of ore averaging 48 per cent iron and 13 per cent silica.

In the Mudgee district there is a deposit of limonite and manganese oxide. This ore varies from 55 per cent iron and 2 per cent manganese to manganese ore carrying about 46 per cent manganese. This deposit contains about 150,000 tons of ore. There is a deposit of brown ore at Newbridge which contains about 150,000 tons of ore carrying 56 per cent iron and 3 per cent silica. The deposits in the Rylstone and Cudgegong districts consist of superficial masses of laminated and concretionary brown ores containing from 47 to 59 per cent iron and from 2 to 17 per cent silica. There is about 443,000 tons of ore in sight in these deposits.

The ore of the Mount Stewart mine, in the parish of Talbragar, is limonite, but on account of the copper and zinc content it will probably not be used except as a flux. This mine contains a reserve of about 400,000 tons. There are deposits of brown ore at Wallerawang carrying about 50 per cent iron and 12 per cent silica which are said to contain about 200,000 tons of ore in sight.

The Williams and Karuah rivers district contains several deposits of titaniferous ore ranging from 42 to 52 per cent iron, from 7 to 22 per cent silica, and from 2 to 13 per cent titanitic acid. The total reserve in these deposits is about 2,021,000 tons.

New South Wales prior to 1914 produced less than 100,000 tons of iron ore annually, but is now producing at the rate of almost 200,000 tons per year.

#### Iron Ore Reserves of New South Wales

District	Kind of Ore	Known Reserve	Per Cent Iron
Cadia	Hematite and Magnetite	39,000,000	52-62
Carcoar	Hematite	3,000,000	55-58
Wingello	Aluminiferous	3,260,000	22-25
Gulgong	Magnetite	120,000	65.12
Cowra	Magnetite	100,000	66.00
Queanbeyan	Magnetite	1,000,000	65.00
Chalybeate	Limonite	1,510,000	44-58
Bredalbane	Limonite	700,000	60.00
Goulburn	Limonite	1,022,000	42-57
Mandurra	Limonite	609,000	52-58
Marulan	Hematite	40,000	48.00
Mudgee	Limonite and Magnetite	150,000	55.00
Newbridge	Brown ore	150,000	56.00
Rylstone	Brown ore	443,000	47-59
Talbragar	Limonite	400,000	.....
Wallerawang	Brown ore	200,000	50.00
Karuah	Titaniferous	2,021,000	42-52

#### VICTORIA ORES WIDELY DISTRIBUTED

The iron ores of Victoria have been known to exist for many years, and numerous attempts have been made to use them, but they do not approach the ores of the other states, either in quality or quantity, and the exploitation of the deposits has been attended with only moderate success. However, the deposits are widely distributed throughout the state, although all are small when compared with some of the deposits in other states. The best known deposit is at Lal Lal, near Ballarat, where the ore is a siliceous limonite averaging 48.10 per cent iron, 17.30 per cent silica, 4.90 per cent alumina, and only a trace of sulphur and phosphorus. Krause estimated the amount of ore available in this deposit at 750,000 tons. Much of the ore occurs as a thin crust in sandstone.



The Nowa Nowa deposit is in eastern Victoria not far north of Lake Tyus. The ore outcrop is on the south-western slope of Mount Nowa Nowa and the ore is hematite and limonite containing from 50 to 66 per cent iron and very low in phosphorus and sulphur, but, like the Lal Lal orebody, it is fairly high in silica. It is estimated that there are 400,000 tons of ore in this deposit.

At Mirboo, in Gippsland, there is a deposit of ore much like the ore at Lal Lal, which is said to contain about 500,000 tons. The only other deposit of note is the Little Whipstick deposit, which is estimated to have a reserve of about 250,000 tons running 48 to 50 per cent iron.

**Iron Ore Reserves of Victoria**

Deposit	Kind of Ore	Reserve	Per Cent Iron
Lal Lal.....	Limonite	750,000	48-10
Nowa Nowa.....	Limonite	400,000	50-66
Mirboo.....	Limonite	500,000	48-50
Little Whipstick.....	Limonite	250,000	48-50
Totals.....		1,900,000	

Other small deposits occur in various parts of Victoria, but little exploring has been done and no authentic data are available regarding the amount or the quality of the ore.

**TASMANIA HAS LARGE DEPOSITS, BUT  
LITTLE DEVELOPED**

Although Tasmania is not directly connected to Australia, it is separated from it by only a small stretch of water, Bass Strait, and it is usually considered as part of the continent. The iron-ore deposits of Tasmania are of considerable extent, but as yet have been little developed. The prominent deposits are those of Long Plain and Blythe River, which are said to contain a known reserve of over 37,000,000 tons.

Long Plain iron-ore field is in the county of Russell between Waratah and the sea coast. The rocks containing the magnetite deposits are serpentine, quartz, and schists of Pre-Cambrian age. The orebodies consist of large disconnected lenticular masses extending almost continuously for three miles. They are from 40 to 60 ft. thick and dip 60 to 80 deg. east. The ore lenses occupy the summits of a series of high steep-walled ridges trending in a general meridional direction. The ore consists chiefly of magnetite, with subordinate amounts of hematite. As a rule the ore is coarse grained, very compact and hard, and toward the center of the deposits it presents an extremely dense crystalline appearance, but at many points in the outcrop alteration to hematite and limonite has taken place. The ore runs 63 to 69 per cent iron, 0.5 to 2.50 per cent silica, 0.01 to 0.09 per cent phosphoric acid, and very low in alumina and sulphur. The main bodies are estimated to contain 20,500,000 tons of available ore.

The Zeehan deposits occur around the Heemskirk Range about 10 miles south of the Long Plain field. The iron ores occur in discontinuous lenticular masses, the largest being on the Tenth Legion property, which is estimated to contain 1,900,000 tons of available ore to a depth of 200 ft. The Davern and Reynolds section is said to contain about 160,000 tons of recoverable ore above the drainage level, while the reserves of Section 1812M and Davern's Prospect are put at 800,000 tons and 850,000 tons respectively. The ore is generally magnetite carrying from 60 to 70 per cent iron and from 0.50 to 2.50 per cent silica. Sulphur is slightly

higher than that found in the Long Plain ores, running from 0.10 to 0.50 per cent. Total available reserve of the Zeehan district can be put at 3,710,000 tons.

The Blythe River deposit is controlled by the Blythe River Iron Mines, Ltd., and is situated on the Blythe River about 6 miles from its mouth. Its outcrop dips at a high angle, and the lode appears to conform with the inclosing sedimentary strata, and is prominently shown on each side of the river by a series of large crags projecting from the slopes of the hill. The ore, which is hematite, carries from 63 to 69 per cent iron, 1.20 to 7.75 per cent silica with low sulphur and phosphorus within the bessemer limits. Estimates of the reserves of this orebody place them at 17,000,000 tons of available ore. The Ruthford iron lode is about two miles from the Blythe River lode and contains the same quality of ore, although the amount is not known.

**HEMATITE AND MAGNETITE IN BEACONSFIELD DISTRICT**

In the Beaconsfield district, deposits of brown hematite and magnetite ores have long been known to exist on Brandy Creek, at Sugar Loaf, at Mount Vulcan, Scott's Hill, and Barnes' Hill, on Anderson Creek. Ironstone deposits in this district are associated with the serpentine rocks. The summit of Mount Vulcan is 200 ft. above the creek level, and bore holes which have been put down indicate the presence of the ore in depth. This body consists of a mantle of brown ore about 50 ft. in thickness, and the reserve is estimated at 500,000 tons. On Scott's Hill north of Mount Vulcan the ore is red and yellow soft limonite and is very similar to the Mount Vulcan ore in composition. Various analyses show these ores to vary from 40 to 56 per cent iron, 5.50 to 19 per cent silica, 1.80 to 5.90 per cent chromic oxide, and they are very low in phosphorus.

Barnes' Hill is situated about 1½ miles from Mount Vulcan. All around its base and ascending the slopes is the red ironstone soil, and on the flat summit boulders of iron ore are abundant. The nature of the occurrence much resembles that at Mount Vulcan, but data available are not sufficient to allow a reliable estimate of the quantity being made. The ore on Barnes' Hill carries from 48 to 50 per cent iron, 4 to 6 per cent silica, and 4 to 6 per cent chromic oxide, and is fairly high in alumina. At Sugar Loaf, two miles southeast, there is a brown hematite lode which is estimated to contain 705,000 tons of available ore above water level, but much of this ore is low grade. The high-grade ore will average about 55 per cent iron and 6 per cent silica. Other deposits of limonite are found on Brandy Creek and at Flowery Gully, containing from 30 to 55 per cent iron and from 8 to 31 per cent silica, but no data are available regarding the quantity. Available ore reserves of the Beaconsfield district in Tasmania can conservatively be placed at about 1,300,000 tons.

The Dial Range deposits are located at Penguin, which is situated on a table-land about 800 ft. above sea level. The orebody consists of red hematite and appears to be a replacement of the bedded conglomerate. Some samples of the ore show the iron content to vary from 51 to 64 per cent and the silica from 8.50 to 23.50 per cent. Other analyses show iron as high as 69 per cent and silica as low as 0.5 per cent. The ore therefore appears to be very variable in composition. The actual size of the orebody has not yet been ascertained and only a rough idea can be formed of its possibilities. However, much of the ore can be

quarried, and the Imperial Mineral Resources Bureau put the available tonnage in the neighborhood of 700,000 tons.

Deposits of iron ore are recorded as occurring on the Nelson River and in other places in Tasmania, but none of them are of any economic importance so far as is known at present.

**Iron Ore Reserves of Tasmania**

District	Kind of Ore	Reserve	Per Cent Iron
Long Plain	Magnetite	20,500,000	63-69
Zeehan	Magnetite	3,710,000	60-70
Blythe River	Hematite	17,000,000	63-69
Beaconsfield	Brown ore	1,300,000	30-56
Dial Range	Hematite	700,000	51-69
<b>Totals</b>		<b>43,210,000</b>	

The actual iron-ore reserves of Australia are not large, but there is still much of the country that is unexplored, and it is quite probable that in the future some large deposits may yet be discovered. New Zealand is credited with at least 69,574,000 tons of known ore, and British Borneo, to the north, contains about 25,000,000 tons, so that the known and probable reserve of iron ore in the British possessions in the Pacific Ocean can be put at about 1,000,000,000 tons.

**Iron Ore Reserves of Australia**

State	District	Iron Ore Reserves		
		Actual	Probable	Possible
Western Australia	Koolan Island	76,550,000	350,000,000	
	Coekatoo Island	20,750,000	100,000,000	
	Wilgie Mia	26,500,000		
	Gabarintha	1,500,000		
	Mount Gibson	10,000,000		
	Mount Caudan	20,000,000		20,000,000
	Koolyanbling	1,000,000		1,000,000
		<b>156,300,000</b>	<b>450,000,000</b>	<b>21,000,000</b>
South Australia	Iron Knob	2,488,200		
	Iron Monarch	130,711,880		
	Iron Prince	32,151,000		
	Mount Bessemer	535,920		
	Pearlilla	45,000		
	Koolka	414,000		
	Donnelly's	470,000		
	Cutana		810,000	190,000
	Miggary		250,000	
	Billeroo		385,000	
			<b>166,816,000</b>	<b>1,445,000</b>
Queensland	Mount Leviathan	2,000,000		
	Mount Philp	20,000,000	20,000,000	20,000,000
	Mount Pisa	1,000,000		1,000,000
	Mount Lucy	350,000		
	Iron Island	1,507,000		
	Olsen's Caves	250,000		
	Oakley Lode	118,000		
	Pleasant Lode	250,000		
	Pittsworth	10,000		
	Rolliston	50,000		
	Biggenden	140,000	160,000	308,000
	Glassford	500,000		
	Mount Perry	100,000		
Peter's Nob	100,000			
		<b>26,375,000</b>	<b>20,160,000</b>	<b>21,308,000</b>
New South Wales	Cadia	39,000,000		
	Carcoar	3,000,000		
	Wingello	3,260,000		
	Gulgong	120,000		
	Cowra	100,000		
	Queanbevan	1,000,000		
	Chalvbeate	1,510,000		
	Bredalbane	700,000		
	Goulburn	1,022,000		
	Mandurn	609,000		
	Marulan	40,000		
	Mudgee	150,000		
	Newbridge	150,000		
	Rylstone	443,000		
	Talbragar	400,000		
Wallerawang	200,000			
Karuah	2,021,000			
		<b>53,725,000</b>		
Victoria	Lal Lal	750,000		
	Nowa Nowa	400,000		
	Mirboo	500,000		
	Little Whipstick	250,000		
		<b>1,900,000</b>		
<b>Total reserve—Australia proper</b>		<b>405,116,000</b>	<b>471,605,000</b>	<b>42,498,000</b>
Tasmania	Long Plain	20,500,000		
	Zeehan	3,710,000		
	Blythe River	17,000,000		
	Beaconsfield	1,300,000		
	Dial Range	700,000		
		<b>43,210,000</b>		
<b>Total Australia and Tasmania</b>		<b>448,326,000</b>	<b>471,605,000</b>	<b>42,498,000</b>

**Summary of the Iron-Ore Reserves of the British Empire in the Pacific Ocean**

Country	State	Iron Ore Reserves	
		Actual and Probable	Possible
Australia	Western Australia	606,300,000	21,000,000
	South Australia	168,261,000	190,000
	Queensland	46,535,000	21,308,000
	New South Wales	53,725,000	
	Victoria	1,900,000	
Tasmania		43,210,000	
New Zealand	South Island	64,000,000	
	North Island	5,574,000	
British Borneo		25,000,000	
<b>Totals</b>		<b>1,014,505,000</b>	<b>42,448,000</b>

**Future of Canada's Mineral Industry Bright, Says Dr. Camsell**

In the report of the Canadian Department of Mines for the year ended March 31, 1925, Dr. Charles Camsell, Deputy Minister of Mines, makes some pertinent remarks regarding Canada's growing mineral industry. Dr. Camsell points out that though the value of the mineral production for 1924 was slightly below that of 1923, "the mining industry cannot be described as being in anything but a healthy condition. It has a capital investment of over \$500,000,000 and employs directly about 60,000 men. It consequently occupies third place among the primary Canadian industries and is exceeded only by agriculture and forest products. While it has shown during the last forty years an extraordinarily steady growth, with only minor fluctuations, the possibilities of mineral production for the future are of greater interest. Three factors taken together give an indication of what this future is likely to be, namely: (1) past performance of the industry; (2) the great extent of our unprospected country; and (3) increasing world demand for minerals." The report continues:

"During the thirty-year period from 1894 to 1924 the curve of mineral production shows an average annual increase of about \$6,300,000 a year. Allowing for a normal increase in population with a consequent increase in consumption, and taking into consideration the fact that a very large proportion of our country, estimated at about 80 per cent, is as yet absolutely unprospected, it is only reasonable to expect this rate of increase will be continued for some years to come.

"There is, however, the third factor—namely, the increasing world demand for minerals—that is likely to accelerate greatly the rate of increase in production. No one who has studied the world production and consumption of minerals can fail to be impressed with the force of the circumstances which are ceaselessly increasing the world's mineral consumption and which are compelling the older highly developed countries of the world, through the exhaustion of their own natural resources, to look to the newer countries to supply their deficiencies. These circumstances will undoubtedly lead to the quicker and more thorough development of Canada's resources.

"Especially among the western nations world consumption of minerals has increased at a far more rapid rate than the growth of population. According to the best estimates the population of the world during the last forty or forty-five years has grown by about 30 per cent. Within the same period coal production has risen by about 300 per cent, pig-iron output by nearly 300 per cent, copper production by over 1,000 per cent, and petroleum by more than 2,000 per cent. A similar rate of growth is apparent in most other industrial minerals, indicating the extraordinary drain that modern civilization imposes on mineral resources.

"These factors are the basis of a well-founded optimism regarding the future of Canada's mineral-producing industry."



# Useful Operating Ideas

## A Simple Ore-Transfer Gate

By E. F. Irving

Master Mechanic, Calumet & Arizona Mining Co., Warren, Ariz.

Gate construction at ore transfers where ore is delivered to a shaft station pocket is usually simpler than where ore trains are to be loaded on an adit or a level. At the Bisbee mines of the Calumet & Arizona Mining Co., transfers from levels to shaft stations equipped with skip pockets are provided wherever convenient. These transfers discharge directly into the skip pockets and are offset from the station so as to bring the discharge gate in a position that will not interfere with the ore trains serving the pockets. Transfer bottoms slope 45 deg.

The clear opening of the gate is 3 ft. wide by about 4 ft. high. The gate is a  $\frac{3}{4}$ -in. plate stiffened with steel rails and sliding in grooves at the sides. Groove construction consists of a plate bolted to the side timbers and carrying a 4x4x $\frac{3}{8}$ -in. angle riveted to the plate. A 1x2 $\frac{1}{2}$ -in. strip supports a front strip  $\frac{3}{4}$ x6 in. in section. Operation of the gate is effected by a 12-in. diameter compressed-air cylinder, which is bolted to the timber structure above the gate. A four-way valve is used for the operation of the cylinder. The design details of the air cylinder are shown in Fig. 2 and the valve is illustrated in Fig. 3.

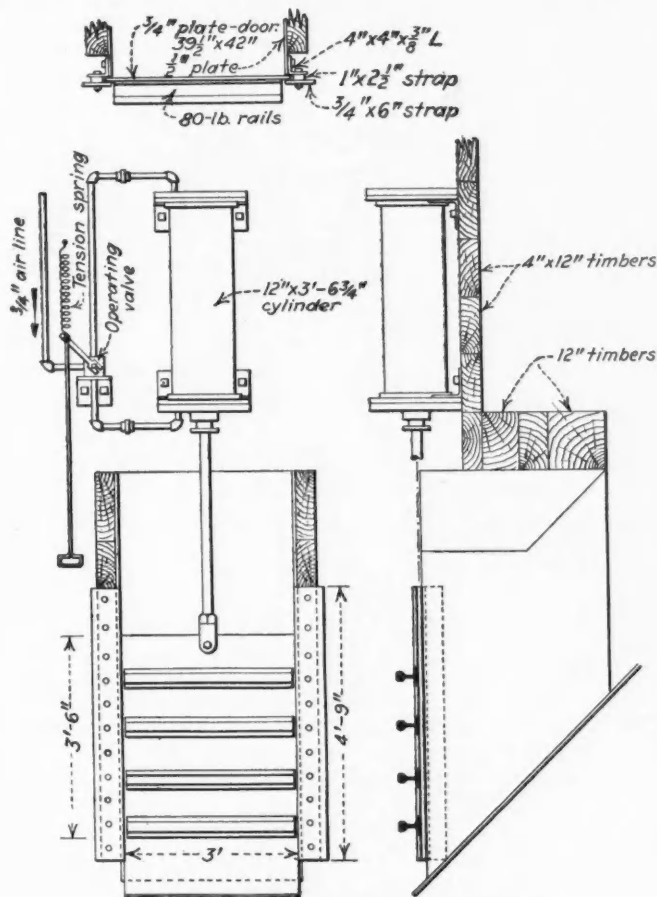


Fig. 1—Transfer gate construction

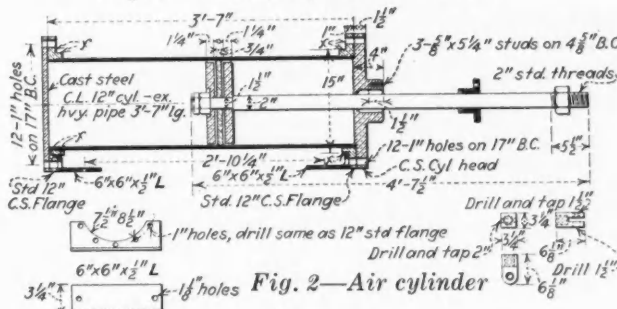


Fig. 2—Air cylinder

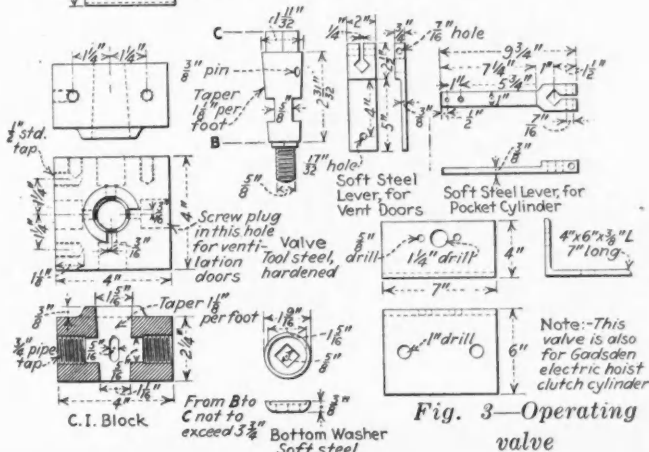
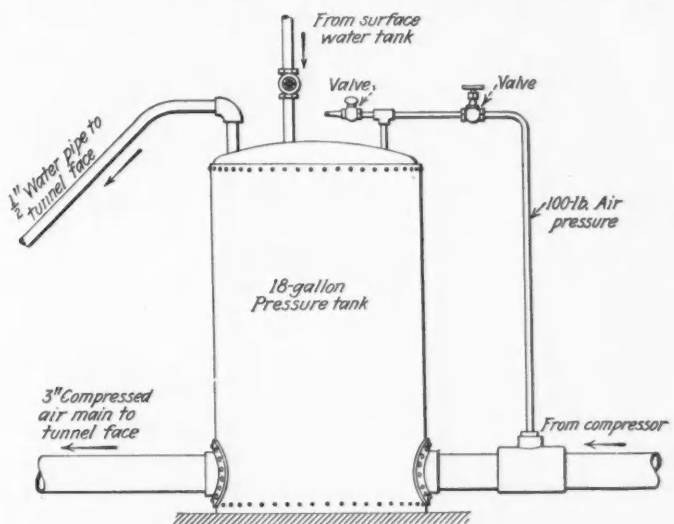


Fig. 3—Operating valve

## Forcing Water to Tunnel Face

In exploration work it is not always convenient to supply water for drilling purposes under sufficient head to force it to the face of a long tunnel. Usually a pump is required, but its operation and installation complicate instead of simplify tunnel work. By placing a pressure



Arrangement of piping for forcing water from pressure tank to tunnel face

tank close to the portal of the tunnel and connecting it to the low-head water supply and the compressed-air main, as shown in the accompanying illustration, it is a

simple procedure to force the water, under a pressure of 100 lb., to the drill water tank at the tunnel face. A ½-in. water pipe is placed in the tunnel and serves the purpose. The rig described was installed by J. A. Harvey, a tunnel contractor in California, and is used in exploration work being done by the Benton Mining & Development Co. at Blind Springs Hill, near Benton, Calif.

### Welding a Compressed-Air Pipe Line

At the Magma mine, at Superior, Ariz., a compressed-air pipe line was installed connecting the compressor unit at the smelter to the mine service system, the line consisting of a 10-in. welded pipe, 3,600 ft. long. The pipe was received in 20-ft. lengths. Two lengths were welded together at a temporary shop before taking out

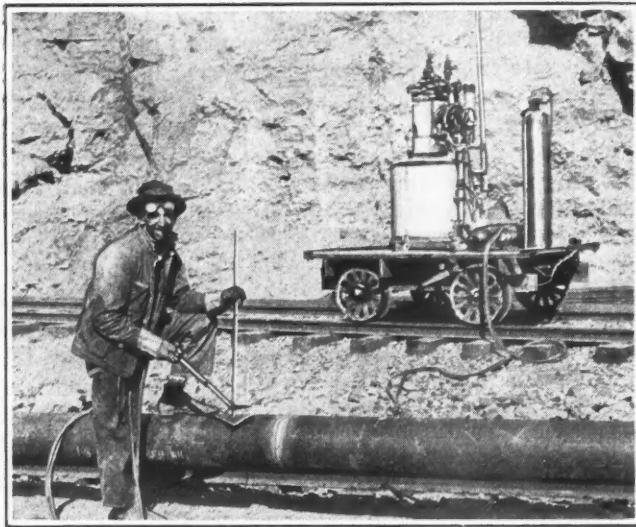


Fig. 1—Portable acetylene generator and oxygen cylinder

upon the pipe line. This reduced the number of field welds by one-half. The 40-ft. lengths were loaded upon a flat car by means of a locomotive crane and transported to the place where they were needed.

As the pipe line was laid upon the surface alongside of the railroad track, in which there were many curves, it was necessary to extend a new section, consisting of several 40-ft. lengths welded together, along a tangent to the completed pipe line. The section was then welded to the pipe in place. This portion of the pipe line was then securely anchored and the other end was picked up by the locomotive crane and sprung into



Fig. 2—Handling welded pipe line by locomotive crane



Fig. 3—Welding a joint

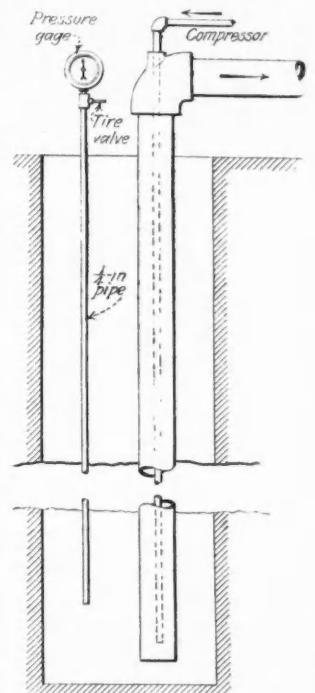
position. The welds withstood the bending satisfactorily.

Acetylene required for welding was supplied by a 50-lb. portable generator shown in Fig. 1. This was mounted upon a small hand car and hauled along the track to the working places. The pipe is leak-proof and its installation was economical.

### Determining Water Flow in Wells

To determine the maximum water flow into a given well which is equipped with an air lift, an auxiliary pipe, ¼ in. in diameter, is placed in the well. This pipe is open-ended, the upper end being provided with a tee, to one branch of which

is attached a pressure gage and to the other a tire valve. After measuring the position of the water level in the well, air is pumped by a bicycle pump into the small pipe until the water is partly or completely expelled from it. The pressure registered is the head of water above the lower end of the pipe. The air lift is then placed in operation, and successive pressure readings are taken until the gage registers a constant pressure. This indicates that the inflow balances the amount pumped. The air pressure indicated is used as a factor in calculating the head of water upon the small pipe, which is in effect a barometer. Flow from the air lift can be measured by turning the discharge into a 100-gal. tank and taking the time required to fill it. The arrangement was used to determine the flow of several wells at the pumping plant of the Mason Valley Mines Co., in Nevada.



Device for determining maximum water flow in a well



## Discussion

### Platinum and Palladium Discoveries in the World

THE EDITOR:

Sir—In the July 18, 1925, number of *Mining Journal-Press* you carried an article written by John Wellington Finch covering his examination of the property of the Empire Platinum Co. in the Encampment district of Wyoming, and a brief history of the platinum and palladium discoveries of the world. All of the men here interested in mining are very much dissatisfied, and feel that Mr. Finch should not have published his views and also that *Mining Journal-Press* should not have published his article. Practically all who have expressed themselves, however, are not qualified to pass judgment on a report made by a man of Mr. Finch's experience and standing. I put the property in condition for examination and was with Mr. Finch when he made his examination. I have the highest regard for Mr. Finch as a mining engineer and fully appreciate his position.

Chino Copper, Ely, Nev., and other copper deposits could never have been developed without the high-class engineer; and I want it understood that I fully appreciate the absolute necessity of the mining engineer at a certain stage of the mining game. The facts are that I have in my possession specimens of platinum and palladium ores taken from the Empire Platinum Co.'s property that cannot be duplicated in the entire world, either in richness or composition, and it is my opinion that Mr. Finch is in error when he says the ores are not out of the ordinary.

My opinion is that each and every engineer who has visited the property has passed judgment from a geological standpoint. We all know that the platinum deposits of the world so far discovered are associated with very basic dikes, and up to date no lode deposits of importance have been found; however, it does not follow that there never will be found a lode deposit of platinum ores of commercial value. One engineer pointed to the fact that if we had a platinum field of importance (lode mines) we would find extensive platinum placers. That does not necessarily follow. Cripple Creek never produced any gold placers, yet the camp covers a wide area of rich ores to the grassroots.

I differ with Mr. Finch and others because I have had a much better opportunity to study these ores in the field. My knowledge of geology and ore deposition is limited to the experience gained by about thirty years at practical mining, together with careful reading of *Engineering and Mining Journal* and *Mining Journal-Press* covering a good many years, and many works on the subject of ore deposition. I am quite positive that platinum and palladium ores of commercial value in lode form have been found that cover a wide area, notwithstanding adverse reports.

The Rambler mine, 6 miles southwest of the Empire Platinum Co.'s property, opened a body of copper ores carrying platinum and palladium. These ores developed in a basic dike so decomposed that classification was

doubtful. The Empire Platinum Co.'s ore occurs in the fault planes of a dike so altered that classification is also doubtful, but I believe it is an amphibole.

On Sept. 24, at a point 8 miles from the Empire Platinum Co. property, I discovered ores that carry platinum, and this ore is within a dike of peridotite, the wall rocks being a light chrome green.

The three different points where these ores have been opened are from 6 miles to 8 miles distant, forming a triangle covering a wide area. We have timber and water power in abundance and also good roads. We need in this district engineers who will put aside for the time being their geological knowledge and find capital to dig on these ores, and like Cripple Creek and other camps that presented unrecorded conditions, the results will show the causes of the deposition of these ores, and will be fully understood by the engineer.

*Mining Journal-Press* can be of great assistance to this district by publishing this letter, as it will be read by the best talent in the mining game, and no doubt some engineer will be attracted to the point where he will thoroughly investigate.

A. F. LINDSLEY.

Centennial, Wyo.

### Pleased to Oblige

THE EDITOR:

Sir—You may publish this. You *must* publish it. Several weeks ago I wrote a personal letter, in a humorous vein, to one of your editorial staff. During his absence on a trip of inspection, the letter was read and an extract published in your Oct. 31 issue. My letter was not intended for publication; but I attach no special blame to the editor, who apparently acted without malice.

Lest I be placed in a false light, I desire to state that the criticism of Guggenheim Bros. or of Mr. Simon Guggenheim originates with some of the discontented croakers of this camp. One rabid individual insists that the Senator made the statement that "the grass will grow in the streets of Silverton before we again operate the Silver Lake." I asked him if he heard the party say it or if he could name any person who heard the remark made. He was utterly unable to come down to brass tacks, but simply muttered that the man must have said something of the kind.

As a matter of fact, the grass *has* grown in the streets of Silverton; but it has now ceased to grow there. As for the American Smelting & Refining Co. "plotting the ruin of San Juan County," some of these ravens seem to forget that the company fitted up the Silver Lake mill as a custom mill and advertised in the *Silverton Standard* for six months or more that it would receive and purchase low-grade ores for treatment in the mill. It would appear that the ores were not brought in sufficient quantity to warrant continuous operation. These pessimistic optimists also forget that as late as 1920-1921 the A. S. & R. Co. did upward of 500 ft. of development work on a claim near the head of Cunningham Gulch. But the county is getting

along pretty well, in spite of the imagined hostility of the naughty smelter trust. Although fifty-ninth in rank of area among the sixty-two counties of the state, San Juan holds second or third place as regards metal-mining activity. The latest item of interest is a sudden demand for pack animals to carry supplies to the Shenandoah mine, on King Solomon Mountain, between Arastra and Cunningham gulches. The group has been under examination by Charles A. Chase and assistants since about July. Let us see how long it will take your reportorial staff to ascertain who are the principals. The local newspaper has a fair idea of the facts, but has not yet received permission to publish.

Silverton, Colo.

WILLIAM B. MCKINLAY.

### Balancing Metallurgical Sheets in a Lead-Zinc Concentrator

THE EDITOR:

Sir—Owing to the high price of both lead and zinc, many more companies are now interested in the production and separation of lead and zinc minerals by flotation. Many interesting articles have appeared in *Mining Journal-Press* recently about how to separate these minerals, but very little has been published on how to keep the metallurgical records.

In flotation concentrators where there is only one primary mineral (such as copper or silver) I believe it is customary to use the old formula (heads—tails) concentrate to calculate the extraction (concentrate—tails) heads on the daily metallurgical sheets. When there are two primary minerals (lead and zinc) the calculations become involved, and it is sometimes impossible to get a nice metallurgical balance by the use of the old formula. Many companies take a sample of the lead tailing and consider it the zinc heading. This works fine if the sampling and assaying are correct and the flow sheet is simple, but many complications may arise. For example, take a flow sheet where the flotation heads go to the lead section and three products are made, concentrate, middling, and lead tailing, the middling being returned to the head of the lead section and the lead tailing going to the zinc section. In the zinc section a zinc concentrate, middling, and final tailing are made. The middling is returned to the head of the zinc section and the concentrate is passed over tables, where a lead product is taken off. Under this condition, the lead tailing is not a true sample of the unrecovered lead.

In another plant the zinc middling might be returned to the head of the lead section with the hope of recovering a little more lead. Under these conditions, the circulating zinc load would cause an erroneous sample of the lead tailing. Of course, there are ways to get around these difficulties, but they all cause grief to the one responsible for the metallurgical sheet.

In nearly all mills it is possible to get a fairly accurate flotation head sample, a lead concentrate, a zinc concentrate, and a final tailing. Herewith is a copy and algebraic proof of a bimetallic formula which I believe has never been published in your paper. It is used by some companies and has proved very satisfactory in simplifying metallurgical calculations. I do not know who first derived it, but it is certainly worth publishing.

T. R. HERNDON.

American Smelting & Refining Co.

Santa Barbara, Chihuahua, Mexico.

#### A Bimetallic Formula

Let:

$L$  = assay of lead in feed;  $Z$  = assay of zinc in feed;  
 $L_1$  = assay of lead in lead concentrate;  $Z_1$  = assay of zinc in lead concentrate;  
 $L_2$  = assay of lead in zinc concentrate;  $Z_2$  = assay of zinc in zinc concentrate;  
 $L_3$  = assay of lead in tailing;  $Z_3$  = assay of zinc in tailing;  
 $Y$  = tons feed;  
 $Y_1$  = tons lead concentrate;  
 $Y_2$  = tons zinc concentrate;  
 $Y_3$  = tons tailing.

$$YL = Y_1L_1 + Y_2L_2 + Y_3L_3 \quad (1)$$

$$\text{Therefore, lead extraction} = \frac{L_1}{L} \times \frac{Y_1}{Y} \times 100 \quad (2)$$

$$Y_1L_1 = YL - Y_2L_2 - Y_3L_3 \quad (3)$$

$$Y_3 = Y - Y_1 - Y_2 \quad (3)$$

$$Y_2L_2 = YL - Y_1L_1 - (Y - Y_1 - Y_2)L_3$$

$$Y_2L_2 = YL - Y_1L_1 - YL_3 + Y_1L_3 + Y_2L_3$$

$$Y_2L_2 - Y_2L_3 = YL - Y_1L_1 - (Y_1L_3 - Y_1L_3)$$

$$Y_2(L_2 - L_3) = Y(L - L_3) - Y_1(L_1 - L_3)$$

$$Y_2 = \frac{Y(L - L_3) - Y_1(L_1 - L_3)}{(L_2 - L_3)} \quad (4)$$

$$YZ = Y_1Z_1 + Y_2Z_2 + Y_3Z_3 \quad (5)$$

$$Y_2Z_2 = YZ - Y_1Z_1 - Y_3Z_3$$

$$Y_3 = Y - Y_1 - Y_2$$

$$Y_2Z_1 = YZ - Y_1Z_1 - (Y - Y_1 - Y_2)Z_3$$

$$Y_2Z_1 = YZ - Y_1Z_1 - YZ_3 + Y_1Z_3 + Y_2Z_3$$

$$Y_2Z_1 - Y_2Z_3 = YZ - Y_1Z_1 - (Y_1Z_3 - Y_1Z_3)$$

$$Y_2(Z_1 - Z_3) = Y(Z - Z_3) - Y_1(Z_1 - Z_3)$$

$$Y_2 = \frac{Y(Z - Z_3) - Y_1(Z_1 - Z_3)}{Z_1 - Z_3} \quad (6)$$

$$Y \frac{(L - L_3) - Y_1(L_1 - L_3)}{(L_2 - L_3)} = \frac{Y(Z - Z_3) - Y_1(Z_1 - Z_3)}{Z_1 - Z_3} \quad (4 \text{ and } 6)$$

$$Y(L - L_3)(Z_1 - Z_3) - Y_1(L_1 - L_3)(Z_1 - Z_3) = Y(Z - Z_3)(L_2 - L_3) - Y_1(Z_1 - Z_3)(L_2 - L_3)$$

$$Y_1(L_1 - L_3)(Z_1 - Z_3) - Y_1(Z_1 - Z_3)(L_2 - L_3) = Y(L - L_3)(Z_1 - Z_3) - Y(Z - Z_3)(L_2 - L_3)$$

$$\therefore Y_1[L_1 - L_3)(Z_1 - Z_3) - (Z_1 - Z_3)(L_2 - L_3)] = Y[(L - L_3)(Z_1 - Z_3) - (Z - Z_3)(L_2 - L_3)]$$

$$Y_1 = \frac{Y[(L - L_3)(Z_1 - Z_3) - (Z - Z_3)(L_2 - L_3)]}{(L_1 - L_3)(Z_1 - Z_3) - (Z_1 - Z_3)(L_2 - L_3)} \quad (7)$$

$$\text{Lead extraction} = \frac{L_1}{L} \times \frac{Y_1}{Y} \times 100 \quad (2)$$

$$= \frac{L_1}{L} \times \frac{Y[(L - L_3)(Z_1 - Z_3) - (Z - Z_3)(L_2 - L_3)]}{(L_1 - L_3)(Z_1 - Z_3) - (Z_1 - Z_3)(L_2 - L_3)} \times 100$$

$$= \frac{L_1}{L} \times \frac{(L - L_3)(Z_1 - Z_3) - (Z - Z_3)(L_2 - L_3)}{(L_1 - L_3)(Z_1 - Z_3) - (Z_1 - Z_3)(L_2 - L_3)} \times 100 \quad (8)$$

In like manner zinc extraction =

$$\frac{Z_1}{Z} \times \frac{(Z - Z_3)(L_1 - L_3) - (L - L_3)(Z_2 - Z_3)}{(Z_1 - Z_3)(L_1 - L_3) - (Z_2 - Z_3)(L_2 - L_3)} \times 100 \quad (9)$$

Ratio of concentration

$$\text{Lead} = \frac{L_1 \times 100}{L \times \% \text{ extraction}} \quad (10)$$

$$\text{Zinc} = \frac{Z_1 \times 100}{Z \times \% \text{ extraction}} \quad (11)$$



## Consultation

### Ball Mill or Rod Mill?

"Which is preferable for grinding a medium hard quartz ore to a product 95 per cent minus 100 mesh, a rod mill or a ball mill? Using a ball mill we would take a product from a jaw crusher; using a rod mill, intermediate crushing would be adopted. Capacity, 100 to 150 tons per day, wet grinding in closed circuit with rake classifiers."

One factor to which attention is immediately directed is the comparatively small capacity of the plant. One ball mill probably could do the work. Therefore, the advantage of having to purchase, house and operate one less machine, presumably a set of rolls or a disk crusher, would be secured. This might be the deciding factor.

From the standpoint of actual grinding efficiency the philosophy that a machine is best fitted to do work in a limited range would argue for the two-stage reduction rather than depending upon a ball mill to crush and grind at the same time.

The following from "The Status of Research in Ore Dressing," by E. A. Hersam, may throw light on the subject:

"The advantages from the use of the rod mill fulfill the prediction of many millmen made long before the extensive and costly efforts of the inventors had brought the mill to its present stage. The rod mill is found to be more efficient than the ball mill, suffers less wear, and produces less slime, also a uniform-sized product not requiring grinding in circuit. However, generally it is not suited to so coarse a feed as the ball mill, yet it continues to offer a fertile field for improvement. An especially thick pulp and extremely fine grinding characterize the expectation of development from present practice.

"The introduction of the mill has met with many mechanical setbacks. The troublesome buckling of the worn rods is being overcome by employing brittle ones; improvements in the drive have been made; and a general increase in size has been found possible.

"In Arizona, where crushing has been developed to a high degree of refinement, the Miami and Inspiration plants remain upon the ball-mill basis. At Morenci, Bisbee, Ajo, and Cananea, rod mills of large size have been adopted with the purpose of replacing others. The difficulty and the detail of improvement in rod mills, and the lack of common familiarity with them, appear to retard extension of their use. Experiments with the mill have led to its adoption after long and careful tests at the Hollinger mill, at Porcupine; and likewise at Cananea, Sonora, Mexico.

"Among others who have worked with the rod mill has been David Cole, 1210 Mills Building, El Paso, Tex. A mill has been operated with 40,000 lb. of 3-in. by 12-ft. rods to treat several thousand tons of ore per day, crushing material of 1-in. size to 10 mesh. A feature of the mill consists in the carrying roll bearing, which is of multiple-roll construction, the rolls being held in a flexible link container, allowing for adjustments. An important saving in power is believed to be secured thereby.

"The change from the tube mill to the ball mill, the ball mill to the rod mill, and the rod mill to the tube mill, and possibly to stamps, seldom has any significance that bears upon general expediency in practice without entering into the specific local conditions. The variables that govern requirements should influence the type of appliance chosen. Different sizes of balls or pebbles, different degrees of fineness, and differences in the character of the rock give grounds for the selection of special types of mills for defi-

nite uses. There is thus far no agreement as to superiority in types under these varied conditions.

"Improvements continue to be made in the form of ball mills and tube mills. No other large machines for fine crushing and grinding are so simple in working principle; yet none are so crude in actual effect and in the direction and application of the forces. At the Hollinger mill the ultimate plan is to dispense with stamps. Ball mills are contemplated to replace conical mills in one instance at Kirkland Lake. Hardinge mills find favor in the Michigan copper region, and in many other places. Thus, experience is at variance. There still is need of knowing more regarding the efficiency of ball mills under different conditions of operation, as far as this relates to power and wear."

### Copper Smelter Settlements

"We have been shipping copper concentrates from our mine at — to the smelter, paying the freight on same from our mine to point of destination, and, according to contract, the copper content is paid for at the average weekly quotation as quoted in the issue of *Mining Journal-Press* containing the quotation for the date of arrival of the concentrates at the smelter.

"Kindly give us your opinion as to whether our shipments should be settled for at the 'Net Refinery' price or the 'Delivered' price, as we pay the freight in the shipment of concentrates from our mine to point of destination."

The terms "Net Refinery" and "Delivered" refer to the finished copper in the form of wirebars, ingot bars, or cakes, not to the concentrates. Finished copper usually is quoted to the manufacturer at a price delivered at his plant or factory, instead of f.o.b. at the refinery. It is perfectly proper for the "Net Refinery" price to be used as the basis for calculating the smelter settlement. If the "Delivered" price were substituted, the smelting company would simply make a deduction of 25c. per hundred pounds of copper in some other manner.

### Where Is Feldspar Mined?

Where are the principal feldspar mines? Who is the largest miner and user of this material?

The crude feldspar produced in the United States amounts to 125,000 to 145,000 long tons per year. North Carolina is the largest producer, with approximately 55,000 tons per year. Other states are, Maine, 21,000; New York, 14,000; Connecticut, 8,000; Maryland, 3,000; California, 2,500; states that produce a limited amount are New Hampshire, Pennsylvania, and Tennessee. In addition to the above there are about 25 firms producing ground feldspar to the extent of 110,000 tons per year.

Since a large amount of feldspar is used in the pottery industry, the markets are largely controlled by firms in Trenton, N. J.—in fact nearly 90 per cent of this industry is in the hands of Trenton firms. Exact data are not available upon which to base definitely a statement as to who is the largest producer. One of the largest, as well as oldest, firms producing and using feldspar is Golding Sons Co., Trenton, N. J. Another is the Eureka Flint & Spar Co., also of Trenton.

# News of the Week

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

**APEX LITIGATION** at Butte — Montana metal mines pay \$400,000 tax under protest, but in conformity with new mine-tax law.

Bureau of Mines budget \$2,529,340; U. S. Geological Survey \$1,796,000—Advisory committee ready to render reorganization report.

Ontario gold production \$24,874,000 for ten months—Vipond begins new mill—Dome and Wright-Hargreaves pay dividend.

United Verde plans large milling plant for Clarkdale and hospital for Jerome—Signal Mines Co. adjudged bankrupt.

Oaxaca, Mexico, approaches normal conditions with many transfers and sales of mining property.

Bunker Hill & Sullivan explores zinc deposits in Ontario and finances aerial tramway from Pine Creek district, Idaho, to Sweeny mill.

Seneca Copper Co. makes first shipment of ore to mill—Isle Royal mine yields 26 lb. copper per ton of rock.

Mason Valley mines ready to resume—Concentrator installed underground on Comstock Lode—Tonopah operations normal.

Nevada-Ray merger delayed by suit—Idaho mine owners lose water suit—Japan obtains forty-five-year oil concession from Russia.

West Rand Consolidated Mines, Transvaal, formulates plan for reorganization of capital.

## Apex Litigation Again Staged at Butte

### W. A. Clark Interests File \$6,000,000 Suit Against Anaconda Copper for Extraction of Ore From Alleged Extension of Poser and Intermediate Veins

THE W. A. Clark interests, represented by the Moulton Mining Co., the Clark-Montana Realty Co., and the Elm Orlu Mining Co., all incorporated in the State of Washington and operating in Montana, and J. Ross Clark, of Los Angeles, Calif., have filed complaint against the Anaconda Copper Mining Co., in the federal court at Butte, Mont., alleging that the Anaconda Copper Mining Co. has extracted some \$6,000,000 of ore from its Badger and State veins, plaintiffs claiming that the apex of these veins lies in their Poser and Intermediate veins.

The bill of complaint recites that the Poser mining claim was located in April, 1875, by J. H. Leffler and T. C. Porter, who sunk a discovery shaft disclosing a well-defined vein of quartz and ore and in 1879 applied for and received patent; that by conveyance from the original locators the Moulton Mining Co. owns an undivided  $\frac{1}{8}$ , the Clark-Montana Realty Co.  $\frac{1}{4}$ , and J. Ross Clark  $\frac{1}{8}$ ; that in April, 1922, the Moulton Mining Co. and W. A. Clark & Bro., a copartnership, being then owners of the Poser lode mining claim, entered into an operating agreement with the Elm Orlu Mining Co. for a period of ten years for the developing and mining of the ground.

It is further recited that defendant is owner of a group of mining claims adjoining the Poser claim and that within the Poser claim is the discovery vein, known as the "Rainbow" lode, the

entire width of the top or apex thereof being included within the surface boundaries of the Poser claim for its entire length and across both the parallel end-lines thereof; that there is likewise within the surface boundaries of the Poser, a vein designated as the Poser vein, the entire width of the top or apex thereof extending longitudinally throughout the claim from end line to end line, except for a distance of 52 ft., where it extends south of the Poser side line; that between the 1,000 and 1,300 levels of the Poser workings it crosses and extends beyond the southerly boundary line and is found extending downward and beneath the surface of an adjoining group of claims of the defendant Anaconda Copper Mining Co.; that there is within the surface boundaries of the Poser claim the apex of a lode, designated the Intermediate vein, which crosses the southerly side boundary line and is found extending downward and beneath the surface of the adjoining group of claims of the defendant.

Plaintiffs declare that only within the year preceding April 1, 1923, they discovered that the Poser vein segment beneath the defendant's workings, which said defendant had been mining for some time and which it described as the State and Badger veins, is a portion of and downward extension of the Poser vein, which apexes within the Poser claim; and that only within the year preceding April 1, 1923, did

the plaintiffs discover that the Intermediate vein segment, which defendant was mining in the vicinity of its 2,600 and 2,800 levels, is the extension of the Intermediate vein, which apexes in the Poser.

After reciting agreements waiving the statute of limitations, plaintiffs allege that ore with a money value in excess of \$6,000,000 has been extracted by defendant from the extralateral extensions of the veins in question.

W. A. Clark & Bro. about May 1, 1923, assigned to Clark-Montana Realty Co. and J. Ross Clark all causes of action in the case, and plaintiffs ask that defendant be required to set forth the nature of its claim in and to the extralateral portions of the Poser and Intermediate veins, and that by decree of the court it be adjudged that defendant be enjoined from interest in or to any portion of either lode and that the title of the plaintiffs thereto is good and valid; and that defendant be enjoined from asserting any claims adverse to the plaintiffs in either the Poser or Intermediate veins between planes described in bill of complaint.

Plaintiffs further ask that defendant be restrained from mining operations in the disputed ground during pendency of the action; that by final decree defendant be perpetually enjoined from mining in either of these veins, and that defendant be required to account for all ores extracted from the premises involved and that plaintiff be given judgment for the amount of value of such ores.

Staff and outside geologists and mining engineers of plaintiffs and defendant have been working on this apex problem for many months.

Plaintiffs will be represented by John



Templeman, Judge Sydney Sanner, and Fred Furman, of Butte; John C. Higgins, of Seattle, and William E. Colby, of San Francisco. Albert Burch is consulting engineer for the Clark interests and Fred Searles has also been consulted.

Defendants will be represented by L. O. Evans and D. Gay Stivers, of Butte, John P. Gray, of Cœur d'Alene, Idaho, and others.

This is the second apex suit filed in Butte within a short time, that of the Midwest Butte against Butte West Side Mines Co., having been filed a few weeks ago. During these trials Butte will be the headquarters of many geologists, mining engineers, and mining attorneys.

### Anna Beaver Lead-Zinc Mine Sold for \$1,420,000

One of the largest transactions in the history of the Tri-State zinc district was the sale of the Anna Beaver Mines Co., at Cardin, Okla., a subsidiary of the Metals Exploration Company, to Harry Payne Whitney, of New York. The purchase price is said to have been \$1,420,000. Whitney, a large stockholder in the Metals Exploration Company, is said to have purchased the entire stock of the Anna Beaver Mines Co. This mine was the largest asset of the Metals Exploration Company. A year ago the United States Steel Corporation obtained an option to purchase the mine for \$1,000,000. Engineers recommended the purchase, but delays of the finance committee permitted the option to expire.

The mine is one of the largest producers in the Tri-State district. It was reopened in 1923 following a long shutdown and during 1923 and 1924 earned enough to pay off outstanding liabilities of \$800,000.

### Ore Discovery at Calumet & Arizona Believed Best in Years

The recent discovery of new ore in the Campbell shaft of the Calumet & Arizona Mining Co., from which a large quantity of high-grade ore has already been extracted, is believed to be the greatest single strike and the most promising orebody that has been developed at the mine in many years, according to Gordon R. Campbell, president of the company.

Mr. Campbell pointed out that the latest strike was the result of "from a five to seven years' campaign, the connecting up of nearly a half mile of tunnel work from the main Junction shaft, and the digging out of numerous stopes." Some exceptionally promising orebodies have also been opened up on the Protection claims, located 251 ft. from the Denn line.

### North-Butte-Tuolumne Copper Merger

A special meeting of stockholders of the North Butte Mining Co. has been called for Dec. 29 to consider taking over the properties of the Tuolumne Copper Co. It is understood that the consolidation will be made on a share-for-share basis.

### Montana Mining Companies Pay \$400,000 Tax Under Protest

MONTANA metal-mining companies have paid for this year to the state about \$400,000 in metal-mines tax, to conform with the metal-mines tax law, which was approved by popular vote at the 1924 general election. Nearly the entire amount was paid under protest, the companies having sixty days to enter suit attacking the law. Anaconda Copper Mining Co. paid \$286,056; Butte & Superior, \$37,773; Elm Orlu Mining Co., \$25,838; Butte Copper & Zinc, \$13,106, and the Anselmo Mining Co., \$5,058. The two last named are subsidiaries of the Anaconda Copper Mining Co.

### Page Mine Restored to Workable Condition

Fifteen years ago the Federal Mining & Smelting Co. abandoned the Page mine, near Kellogg, Idaho, because there was no way to separate the lead and zinc, the latter being not only worthless but also subject to a smelting penalty that wiped out all profit. It is different now, for flotation has solved the problem of separation and recovery of both minerals. During the last year the Federal company has unwatered the old Page mine and restored it to good workable condition. The oreshoot developed by drifting 600 ft. from the bottom of a 600-ft. shaft is being sampled and checked with the old assay records. In the meantime a crosscut is being run south from the bottom of the shaft, following a diamond-drill hole which, according to the old records, penetrated a lead-silver oreshoot 5 or 6 ft. thick 600 ft. away.

### Seneca Copper Makes First Shipment

#### Arcadian Mayflower-Old Colony and Cliff Continue Development

Seneca, in the Michigan copper district, made its first shipment of copper rock on Dec. 1, 600 tons being hauled by the Copper Range railroad to the little Tamarack mill, a section of which has been overhauled for Seneca's use. Isle Royale, in the Michigan copper district, a subsidiary of Calumet & Hecla Consolidated, is obtaining a high yield, close to 26 lb. of refined copper per ton of rock treated, through fairly close selection and in presence of considerable small mass copper. Estimated refined output per month is 800,000 lb. At the North Kearsarge branch of Calumet & Hecla Consolidated, No. 1 shaft is shipping about 600 tons of rock daily, refined monthly output being between 350,000 and 400,000 lb.

At Arcadian Consolidated, in the Michigan copper district, the crosscut from the 1,250 level, which is headed for the No. 8, or Allouez conglomerate, should reach its objective in a month's time. Prospects for mineralization in

the lode are believed to be good, inasmuch as copper was found where the vein was cut at the 900 and 1,700 levels. At Mayflower-Old Colony, the drift south on the St. Louis amygdaloid has penetrated the vein for 50 ft. Though values have not yet been encountered, this is not considered unusual, as it is quite characteristic of the copper-bearing lodes in the Michigan district that these lodes have barren stretches. At Calumet & Hecla Consolidated's Cliff exploration, a stockpile of copper rock is being accumulated as drifting proceeds in what is believed to be the Calumet amygdaloid. The vein is wide and apparently contains good values for a width of 8 ft. along the foot and 2 ft. on the hanging side.

### United Verde Copper Co. Plans Large Milling Plant

Plans for the new mill of the United Verde Copper Co., which will be located close to the present crushing plant at Clarkdale, are well advanced. The first unit will have a capacity of 1,000 tons per day, and the great low-grade orebodies in the mine, the copper content of which is too small to permit of profitable smelting, will be developed and worked, adding largely to the gross output of the property and furnishing employment to many additional men. Active construction work will begin just as soon as the plans are finally completed and tenders can be called for. The building of the mill will add largely to the number of men on the company's regular payroll.

### Lessees Make Shipments From Property of San Rafael Development Co.

Lessees on the Quartz Mountain property of the San Rafael Development Co., in the Broken Hills district, 42 miles northeast from Luning, Nev., are pushing production to mine as much as possible of the ore in sight before the expiration of their lease on Dec. 31. During six months' operation, lessees have shipped twenty cars of ore, with a gross value of over \$50,000, or about \$60 per ton. Values are principally in lead, as carbonate, with some galena, and silver, although the deeper workings show an increase in the gold content, up to 1.5 oz. per ton.

The owners of the property have started a vertical shaft 300 ft. south of the lease workings, and plan to use this as the principal opening for development work. The shaft is now 75 ft. deep and should enter the vein at about 100 ft. depth.

### Elm Orlu Mining Co. Secures Option on Bigfoot Property

The Elm Orlu Mining Co. (W. A. Clark estate) has taken an option on the "Bigfoot" property between Boulder and Whitehall, Mont. As the property is three miles from an electric power line, the preliminary work will be done with gasoline equipment, which was shipped recently to the property by a Butte machinery house.

## News From Washington

By PAUL WOOTON  
Special Correspondent

### Bureau of Mines Budget \$2,259,340; Geological Survey \$1,796,000— Alaska Railroad \$1,855,000—Reorganization Committee Report Ready

**T**HE BUDGET which has just been submitted to Congress by the President carries \$2,529,340 for the work of the Bureau of Mines during the next fiscal year. This is \$798,390 more than was carried in last year's budget. The total, however, does not include the appropriation which will be transferred from the Bureau of Foreign and Domestic Commerce for the activities which will be taken over by the Bureau of Mines.

New work on helium accounts for the increase. Under the act passed March 3 the Bureau asks \$830,000 for helium production and investigations. The money is to be available principally for the leasing, purchase or construction of facilities for the production and purification of the gas.

For the preparation of the reports on the mineral resources of the United States, the budget provides \$123,000, the amount available for the current fiscal year.

Because of the transfer to the Bureau of Standards of the ceramic work, the budget carries only \$173,000 for the experiment stations. The amount appropriated at the last session for that purpose was \$198,300.

The new budget carries \$211,000 for oil and gas investigations and \$89,000 for the oil-shale work, practically the same amounts being expended this year.

For metal-mining investigations, \$116,100 is asked, substantially the same amount allowed for this year. The investigations under that heading include those looking to the elimination of waste in mining and inquiries into the economic situation of the mining, quarrying, and metallurgical industries.

Among the other items in the Bureau's budget are: Mine-accident investigations, \$396,000; mining investigations in Alaska, \$10,860; operating mine rescue cars and stations, \$277,380; fuel testing, \$154,000.

For the Geological Survey the budget carries a total of \$1,796,000. During the present fiscal year the Survey has \$1,879,310 at its disposal. The principal subdivisions of the estimates to be passed upon by this Congress are: For activities prescribed by the leasing acts, \$312,000; classification of lands, \$240,000; stream gaging, \$151,000; continuation of investigations of the mineral resources of Alaska, \$63,000; for geological surveys, \$348,000; for topographical surveys, \$437,000; geologic maps, \$97,000.

The budget also provides \$1,855,000 for the operation, maintenance, and improvement of the Alaska Railroad.

#### BUREAU ADVISORY COMMITTEE TO SUBMIT FINAL REPORT ON ORGANIZATION

An important meeting of the Bureau of Mines advisory committee will be held on Dec. 12 in Washington. Final reports of the subcommittees will be

submitted at that time and the organization of the new economics branch will be discussed. The broad outline of organization has been approved, but much remains to be done in the way of subdivision and in the selection of personnel to head the commodity sections. C. P. White, in addition to his duties as assistant director, will continue to direct the coal work, which is expected to absorb one-half of the appropriations which will be available for use in the economics branch.

It is expected that most of the commodity places can be filled from the present staff of the Bureau, but one requirement will be a first-hand knowledge of the industrial department of the mineral commodities.

#### War Minerals Relief Work Near Completion

Announcing that all War Minerals Relief claims had been fully adjusted, liquidated and paid, with one exception, Secretary Work of the Interior Department has forwarded a final report to the President and Congress practically terminating this work of the government.

The report shows that the last ninety claims were considered during the past year and that a balance of more than \$950,000 remained unexpended out of the original appropriation of \$8,500,000.

There are now pending in the courts five suits by claimants under the act, each of which challenges interpretations of the act and its amendments by the Secretary. All these suits are being defended as actions taken in the proper exercise of the judgment and discretion vested in the Secretary by the act. The suits involve items which were either specifically ruled upon by the Supreme Court or items which have been consistently and repeatedly, from

#### Small Milling Units to Treat Low-Grade Ore Underground

**T**HE Consolidated Virginia Mining Co., on the Comstock Lode near Virginia City Nev., has completed the installation of a 20-ton Medford mill at the C and C shaft and it is now operating successfully on dump and mine ores. Zeb Kendall, president of the company, states that he plans to install several of these mills underground, in various parts of the mine, in or near stopes where low-grade ore is known to exist, thereby saving all handling and hoisting expense. The old stopes and deeper abandoned workings will hold the tailings and the Sutro tunnel will take care of all water. This experiment will be watched with much interest.

the earliest administration of the act, denied as not within the act.

All claims have been considered and have been fully adjusted, liquidated, and paid, and no claim remains for adjustment, liquidation, or payment, except one, in which objections will be heard. The Secretary regards the administration of the act of March 2, 1919 (40 Stat., 1272), and of all acts amendatory and supplemental to it, as fully and finally executed as to all considerations, adjustments, liquidations, and payments, of claims, with one exception as aforesaid, unless at some future time court action in the cases hereinbefore referred to should make obligatory and mandatory other or additional considerations, adjustments, liquidations, and payments.

#### Fire Damages Mine of Fairview Mining Co.

Fire which broke out on Dec. 4 in the Cardinal tunnel of the Fairview Mining Co., Nederland, Colo., killed two men, injured several others, and did considerable damage to the main tunnel. The twenty-two trapped men were in the mine eighteen hours before rescue workers could reach them. All of the men then were helped from the still smoking chambers, the last leaving the mine about 1.30 a.m., Dec. 5.

The Fairview is a silver, gold, and lead mine. The men were entrapped early in the morning when a fire broke out in the mine and swept the wooden timbering for nearly 200 ft. in the main tunnel. The fire was followed by a cave-in which blocked the portal and imprisoned the miners.

The miners escaped death primarily through the building of a bulwark in a wing of the west drift off the main tunnel, 4,100 ft. from the portal. Behind this shelter they avoided the deadly gas fumes and smoke. Clothing, stones, and dirt were used to plug the holes in the bulwark.

#### Increased Activity at Milford, Utah

High lead prices have caused a decided increase in activity at the camp of Milford. Shipments are being made steadily from the Moscow Silver mines. A. C. Nebeker is directing operations at the Magnolia property, where a shaft is being sunk to explore a body of silver-lead carbonates productive from the surface to the 200 level in prospect workings. This shaft will be sunk to the 500 level before crosscutting is done.

Leasers are shipping steadily from the Wild Bill, the Cedar Talisman, and other properties. The old Horn Silver mine is also being worked by leasers, who are taking out sufficient ore to net a good return.

Contractors are setting up the machinery to be used in sinking the new shaft in the Utah Premier mine. California capitalists are preparing to resume operations in the Humboldt mine, where a shaft is down 500 or more feet. The mine has up-to-date equipment.

Operations are to be resumed in the Croff mine. The Lynn Big Six Mining Co. is sinking on two feet of ore.



## Oaxaca Approaches Normal Conditions

Mines Abandoned in 1912 Now Operating—Many Transfers and Sales Reported—Wages Low and Labor Ample for Present Needs

By W. L. Vail  
Special Correspondent

MINING operations in the State of Oaxaca, Mexico, were practically abandoned in 1912, because of constant revolutionary activities which interfered with labor and communications. These conditions naturally gave mining a serious setback. Many operators left their properties in charge of caretakers, and in some instances the mines were flooded and left in a deplorable condition. At a few of the camps occasional work was done, but in most the extraction of ores of high grade, when possible, was the limit of practicable operation. Actual development was abandoned.

For some time conditions have approached normal, with the result that several of the larger mining companies operating in Mexico have been turning their attention to this state. Labor conditions are quite satisfactory, wages averaging from one to three pesos daily. There is no scarcity of labor, and as yet the camps in this state have not been organized by labor agitators as in some of the other mining regions of Mexico.

State and federal authorities are friendly and helpful, apparently desirous of assisting in reorganizing one of the state's principal sources of wealth. A great deal of money has been spent on road improvement during the last two years.

Sale of the celebrated San Juan mine, formerly owned by the San Juan Mining Co., to the American Smelting & Refining Co. was reported in *Mining Journal-Press* recently. The purchase included, in addition to the San Juan proper, the San Juan Bautista, Ampliacion de San Juan, San Juan Anexas, San Juan Menor, as well as the Peso de Oro and La Riqueza, properties formerly held by C. A. Hamilton. It is understood that the A. S. & R. Co. is arranging options on numerous other properties in the Taviche district, notably those of the Consolidated Mining Co. The transfer of these properties would include about 15 mines, including the largest producers in this camp. The Benjamin mine, of this group, was shipping ore to Veracruz for European smelters prior to the opening of railways in Mexico and continued in production up to the time of the revolution.

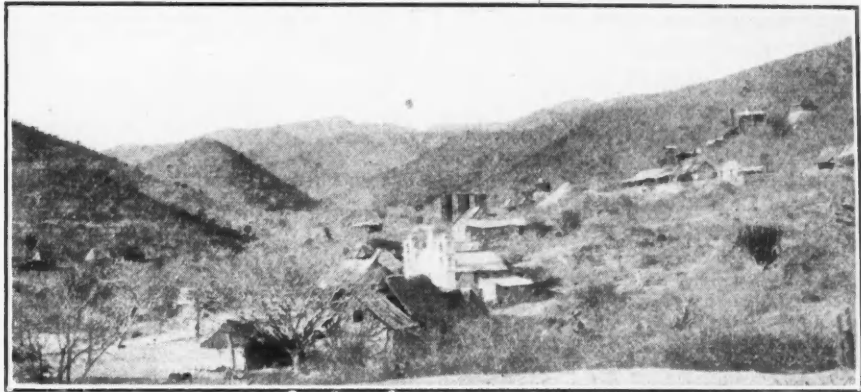
It is understood that the new owners of the San Juan are preparing to erect a large reduction plant at Taviche, which will stimulate small operators to develop their properties, as Taviche has ample railway facilities and the proposed plant will be in the heart of the mining district.

A short distance from Taviche, on the line of the Mexican Southern Railway, is the San Jose Garzona mine, located at La Garzona. This mine was acquired by the Marcus Daly-Girard interests in 1924. Development work has been pushed persistently under the management of Donald G. Miller, and with excellent results.

New York capital is also operating the San Fernando lead mines 25 to 30 miles from the station of San Pablo, on the Mexican Southern Railway, where a large force of men has been engaged for several months in development work. The high price of lead has been a particular stimulant to the owners of this mine and adjacent properties in which similar ores occur.

### KANSAS CITY CAPITAL INVESTED IN TOTOLOAPAM DISTRICT

Over in the Totoloapam district, about 45 miles southeast of the City of Oaxaca, one of the oldest camps in the



La Topada, Oaxaca, Mexico, site of operations of Majestic Mining Co.

state, the Cia Mexicano Explotadora de Minas La Majestic S. A. has been actively engaged in development for the last year and a half. This company, organized about two years ago with Kansas City, Mo., capital, acquired a number of leases from C. W. McCarty in La Topada camp of this district, the principal ones being La Leona, San Pablo, and San Ignacio, a group covering an area of about three square miles. La Leona is a high-grade silver-gold property, and had a high production prior to the revolution. Development work which was started immediately upon the taking over of the properties by the new owners is being steadily carried forward. The company recently installed a mill. Dr. McCarty is president of the company and has personal charge of the development work. Up to the time of transfer, these properties had been idle for twelve years. The Kansas City interests are evidently firm believers in the future of the section, as they are backing the development without stint financially.

The principal activity in the Sierra Juarez district north of the City of Oaxaca is confined to the operations of the Peñoles company, a subsidiary corporation of the American Metal Co. Since February of this year the Peñoles company has been operating the Natividad mine and a number of smaller contiguous properties. The old Natividad mill is being repaired and is expected to begin operation in March of next year with a capacity of about 125 tons daily.

## Bunker Hill to Finance Pine Creek Tramway

The Bunker Hill & Sullivan Mining & Concentrating Co., of Kellogg, Idaho, has entered into an agreement with the Sidney Leasing Co. and the Sidney Mining Co. under which it will finance the construction of an aerial tramway for the delivery of ore from the Sidney mine, on Pine Creek, to the Sweeney mill, owned by the Bunker Hill company. The tramway will be between three and a half and four miles long, and its cost is estimated at \$75,000. The mill will be changed to accommodate the zinc-lead ore from the Sidney mine and from other Pine Creek mines, the purpose being to make the Sidney tram a trunk line with which other lateral lines may connect. One unit, or half of the mill, will be adapted to the Pine Creek ores and the other half will continue to be used for lead-silver

ores. The interest the Bunker Hill is taking in making Pine Creek mines productive, together with its half ownership of the Star, which will soon be in position for large production of zinc-lead ore, is believed to indicate that the company has plans for the early construction of an electrolytic zinc plant at Kellogg, an enterprise which it has had in view for several years.

## Bunker Hill & Sullivan Continues Exploration in Sudbury District

One of the most important programs of mining exploration work now in progress in Canada is that carried on by the Bunker Hill & Sullivan company on the zinc property at Chelmsford, in the Sudbury district of northern Ontario, which that company took over under option in July. Officials of the company were in Toronto recently on their return from an inspection of the property, where, in accordance with the company's plans to do 5,000 ft. of diamond drilling per month, four drilling outfits were in operation; and high values of zinc are understood to have been obtained.

Though no announcement has been made as to the further intentions of the company, it is believed that considerable additional work to ascertain the extent of the deposit will be necessary to determine whether it is of sufficient magnitude to warrant sinking a shaft, preliminary to actual mining.

### Ore Discovery May Extend Present Bisbee Field

An ore discovery recently made in the Bisbee-Warren district, Cochise County, Ariz., on the Galena claim, is of special interest in mining circles, inasmuch as the Federal Government has denied patent applications on a number of claims in that locality because of the failure of applicants to prove the existence of mineral values. The new ore, according to advices received in Los Angeles, shows a gold and silver value of \$1.50 per ton, 2.4 per cent copper, and 2.9 per cent lead, making a total of \$14.20 per ton at present metal quotations. The government has been requested to make a re-examination of the ground specified.

### Tonopah Extension Has Water Under Control and Will Soon Mine Deep Ore— Operations Normal

No recent developments of importance have been reported from Tonopah, with normal operations. Bullion shipments indicate production to be about \$250,000 in value for November.

Rescue Eula, working from the 1,100 level, has sunk a 48-ft. winze on the Anderson vein and a 40-ft. winze on the Green vein. The Anderson vein has become too narrow and low grade in the winze to mine, and work has been discontinued. The Green vein has shown good ore for the entire 40 ft., and this winze is being continued, the ore being shipped to the West End mill.

Tonopah Extension produced bullion valued at \$93,816 during October, with operating loss of \$16,508, or about \$11,000 more than in September. Production for the first fifteen days of November was valued at \$41,000. This company is now pumping 1,600 gal. of water per minute and rapidly lowering the water pressure in the western portion of its property.

Tonopah Belmont, Tonopah Mining, West End, and Tonopah Divide (Midway) report normal development and production without change.

### Mason Valley Mines Co. Ready to Resume

It has been officially announced by Emmet D. Boyle, general manager for the Mason Valley Mines Co., owner of large copper properties near Yerington, Nev., that the company's mines and 1,000-ton flotation plant will start production before Jan. 1. Capacity operations will not be reached for some time, and concentrates will be stored temporarily until the Thompson smelter of the company, 12 miles distant, is blown in. The smelter has been overhauled, is in working condition, and can be started on short notice. Its two-furnace capacity is about 900 tons per day, and as the flotation plant will produce only 100 tons of concentrate a day, the balance of the ore necessary for the operation of one or two furnaces will have to be shipped from the mine or provided from miscellaneous custom ore.

### Missouri Proposes Production Tax on All Minerals

**P**OLITTE ELVINS, counsel for the St. Joseph Lead Co., which operates mines in St. Francois County, Mo., stated recently that the proposal of Governor Sam A. Baker to amend the state constitution to impose a tax of not less than 1 per cent nor more than 2 per cent upon the market value of all minerals taken from mines of Missouri would cost his company \$300,000 a year. Elvins says that "such a tax on gross receipts of mining companies would be ruinous, and would seriously interfere with mining developments in the state."

The state now levies a small tax on the output of mines to defray the expenses of state inspections. The new tax would be levied against all mining products such as lead, zinc, iron, spelter, coal, marble, granite, gravel, building stone and clay.

### West End Consolidated Continues Shipments From Mabel Mine

The West End Consolidated Mining Co. has shipped Lot 52 from its Mabel mine, 20 miles from Mina, Nev., with estimated value of \$150 per ton in silver, lead, and gold. Average value of the 52 cars shipped during the last three years is about \$130 per ton.

The deepest development in the mine is from a 60-ft. winze below the 500 level, which is the bottom level from the vertical shaft, and good ore has been found at this elevation. Development and stoping are also being carried on from the 300 and 400 levels.

### Veta Grande Mining Co. Opens Gold-Silver Ore Deposit

Ore carrying gold and silver has just been disclosed in some new surface work on one of the Veta Grande Mining Co.'s claims at Minden, Nev., about 2,000 ft. east from the main workings, according to E. J. Roberts, president of the company. Plans are now being made to sink on this new discovery and make some high-grade shipments.

The work of cleaning out the 1,200 ft. lower tunnel has progressed to the silver vein, 350 ft. from the portal. Clearing the tunnel to the gold vein, tapped at 850 ft., will be pushed as rapidly as possible.

### Ojibway Levies Assessment

The calling of an assessment on the stock of the Ojibway Mining Co., in the Michigan district, has attracted some attention to this property. A few years ago the company purchased additional acreage on the dip of the Kearsarge lode, giving great depth on the formation. With the resumption of operations at Seneca to the south and on Cliff lands to the north, owned by Calumet & Hecla Consolidated, more interest is being manifested in Ojibway.

### Sloss-Sheffield Wins Freight Rate Case

Returning a decision in favor of the Sloss-Sheffield Steel & Iron Co., of Birmingham, Ala., the United States Supreme Court ruled that approximately \$100,000 reparations was due the Alabama company from the Louisville & Nashville and other railroad companies.

The case, known in various courts of the country as 4800 I. C. C., was instituted by the Sloss-Sheffield Steel & Iron Co., which contended that rates on pig iron during the years from 1910 to 1911 were excessive. At that time action was taken to reduce the rates, and reparations were asked.

The rates complained of were found unreasonable by the Interstate Commerce Commission, but reparations were not awarded, and the steel and iron company then brought suit to recover excess charges.

### Suit Filed to Prevent Nevada-Ray Merger

The proposed porphyry copper merger has been halted temporarily by a suit filed in the Supreme Court of New York County to prevent the merger of the Ray Consolidated Copper Co. with the Nevada Consolidated Copper Co. by Frank C. Armstrong, a stockholder in the Ray company. He alleges fraud and conspiracy and claims the stockholders in Ray will lose \$12,000,000 if the plan goes through. A temporary injunction has been granted forbidding the defendants to participate in any meeting for the purpose of effecting a consolidation or otherwise to dispose of the assets of the Ray to Nevada or to any other corporation.

The petition in the case asserts that on Dec. 31 last the Ray company held current assets of \$7,063,050 and had a large amount of high-grade ore in the ground and that the stock was worth \$4.48 a share. But after consolidation with the Chino Copper Co., a smaller concern, it is stated, the value of the stock was reduced to \$2.71, the combined assets being worth only \$8,545,916. It is alleged that the Nevada company had current assets of \$8,959,552, with unmined ores of a lower grade than the Ray properties, and that the Ray stockholders were to get 3,077,179 shares of an increased issue of 3,100,000 shares of Nevada stock, for the properties of their company.

The proposal to merge the Ray, one of the leading porphyry copper companies, with Nevada has been under consideration for several years. Actual proposal of the merger, however, did not come until Oct. 19 last, when D. C. Jackling, president of Nevada Consolidated, announced that the directors of both companies had approved the consolidation and that the principal stockholders also approved the plan. Special meetings of the stockholders of both companies were called for Nov. 10 to vote on the merger. This meeting was adjourned, and following meetings also were adjourned because of the preliminary injunction obtained by Mr. Armstrong.

At the first postponement of the stockholders' meeting, executives of



both companies stated that the contention of Mr. Armstrong that Ray was a more valuable property than Nevada, and that stockholders of his company were entitled to better terms than the share for share offered, was without foundation, and expected that the matter under controversy would soon be disposed of in the courts.

The Nevada Consolidated Copper Co. is controlled by the Utah Copper Co., which in turn is controlled by the Kennecott Copper Corporation.

Officers and directors of the two companies, the corporation, and also Utah, Chino, and Kennecott Copper companies are named in the complaint. Armstrong claims that the directorates of both companies are interlocking, that their offices are connected, and that the defendants mingle freely in the daily transaction of their business.

Stockholders of both Ray and Nevada were scheduled to hold special meetings on Dec. 8 to act on the merger.

### Water Suit Lost by Idaho Mine Owners

The United States Supreme Court has denied a petition for writ of certiorari in the case of the Bunker Hill & Sullivan Mining & Concentrating Co., Hecla Mining Co., Federal Mining & Smelting Co. and Gold Hunter Mining and Smelting Co. versus Jacob Polak, and by this action made final the decision of the circuit court of appeals rendered Aug. 24, 1925. In refusing to review the findings of the lower courts, the Supreme Court gave no reasons, the chief justice merely announcing that the petition had been denied.

This litigation involved specifically the use of the waters of the south fork of the Coeur d'Alene River. Polak brought suit because the various mining companies operating upstream above his 320 acres, by running the waters of the south fork through their mills, polluted them and left them milky with sediment which, he claimed, rendered the water unfit for his use.

The mining companies filed a most elaborate brief in an effort to induce the Supreme Court to review the findings of the district court and circuit court of appeals, but the Supreme Court cast this aside when it refused to take jurisdiction, and the decision of the circuit court of appeals thereby becomes final.

### Signal Mines Adjudged Bankrupt

Representatives of those interested in the affairs of the Signal Mines Co. met recently in Prescott, Ariz., before Referee T. J. Byrne, and appointed David W. Russel, secretary-treasurer of the Yavapai County Savings Bank, as trustee of the property. The company was adjudged a bankrupt on Nov. 11 by Judge Bourquin of the federal court.

The company owns the old McCracken silver mine, which it has leased to the Western Metallurgical Co. The leasing company, on account of the amount of manganese in the ore, was not successful. If an agreement can be reached with the creditors the leasing company plans to test out the ores with the flotation process.

## Toronto Letter

By Our Special Correspondent for  
Northern Ontario

### Ontario Gold Production for Ten Months \$24,874,000

#### Dome and Wright-Hargreaves Declare Dividend—Vipond Begins Work on 300-Ton Mill

Returns from the Department of Mines for Ontario, giving monthly gold production, show that in October there was milled in the Porcupine camp 237,163 tons, from which was recovered bullion to the value of \$1,893,651. This is a decrease of 1,600 tons and \$316,000 in value, compared with the preceding month, and is due in part to the smaller tonnage milled by the Hollinger, on account of changes being made in the mill.

In the Kirkland Lake area the tonnage milled was 34,923 tons and the recovery was \$460,149, an increase of 1,450 tons and \$8,300 in value.

The total value of the gold production of the province for the ten months ended with October was \$24,874,000, compared with \$25,669,000 for the full calendar year of 1924.

The directors of the Dome Mines have declared the regular quarterly dividend of 50c. a share payable Jan. 20, to shareholders of record Dec. 31.

In the new McIntyre shaft, connection has been made with the old 1875 level. Steady progress is being made in sinking, the average being approximately 190 ft. a month.

Officials of the Vipond mine have announced that during the last two months discoveries have been made which are of sufficient importance to justify the immediate increase in the mill capacity to 300 tons a day. A start has already been made on this, several concentrating tables and another tube mill having been added. A discovery underground is known as the No. 8 vein, which has been cut on the 200, 300, and 500 levels. The grade is understood to be higher than the general average of the mine, which is approximately \$9.50 a ton.

The Lucky Tiger mine has completed its option for the Pawnee Kirkland property. The transaction will have to be ratified by the shareholders of the last-named company, at a meeting for this purpose which will be called immediately. It is not expected, however, that any opposition will develop. Under the terms of the agreement Lucky Tiger will have to sink a shaft and do a considerable amount of underground exploration work, but this will be preceded by about six weeks of diamond drilling.

Directors of the Wright-Hargreaves mine have declared the regular quarterly dividend of 2½ per cent, plus an extra 7½ per cent dividend, payable Jan. 1 to shareholders of record Dec. 15. This dividend calls for a disbursement of about \$275,000.

Good results have been secured during the last season by the Pioneer Syndicate, which is owned by the London, England, firm of Hamilton, Erlich, Turk & Bell, who are also the controlling factors in the Huronian Belt

Co., which controls the Vipond, Keeley, and Canadian Lorrain. The field man of the Pioneer Syndicate is W. M. Goodwin, formerly Editor of the *Canadian Mining Journal* and for some years previous to that on the staff of the Canadian Geological Survey. A group of claims has been secured in the Michipicoten district. The syndicate plans to do considerable development.

It is expected that a judgment will soon be handed down by the Supreme Court of Canada in the action over the right of the Nipissing Central Railway to build into the Rouyn district of northwestern Quebec. No matter what the decision may be it is understood that an appeal will be taken to the Privy Council in England and arrangements have been made to expedite the action before the Privy Council so as to obtain a final judgment as early as possible.

### Great Lakes Shipping Amounted to 98,000,000 Tons in 1925

The shipping season just closed was the greatest in the history of the Great Lakes, with an approximate total tonnage of 98,000,000, due largely to better conditions in the steel industry, which caused a record total of iron ore shipments.

The year included a slight but notable expansion in deep-sea shipping, although the Welland Canal, entrance to the Great Lakes, west of Ontario, is limited to vessels drawing thirteen feet.

The three commodities constituting the bulk of the lake traffic were ore, coal and grain. The tonnage figures last year and this year on these were: Ore, 1924, 53,000,000 gross tons; 1925, 63,000,000 gross tons; coal, 1924, 26,000,000 net tons; 1925, 23,000,000 net tons; grain, 1924, 543,500,000 bushels; 1925, about 500,000,000 bushels.

The Duluth port records this year showed 10,305 ships arriving, compared with 9,783 last year.

### Japan Obtains Forty-five-year Oil Concession From Russia

The agreement just reached between the Soviet government and four Japanese companies, concerning the exploitation by the Japanese of the former Sinclair oil fields on Sakhalin Island, was signed Dec. 10 and will run for forty-five years. It covers exploitation of half of the existing oil fields in northern Sakhalin.

This area was to have been developed by the Sinclair interests, which, the Soviet government alleged, defaulted on the contract. The Japanese are to have equal opportunities with other foreigners in acquiring the remaining 50 per cent of the wells on the island in the event the Soviet government leases these wells on concessions.

The Japanese firms make no financial advances, but agree to pay royalty varying from 5 to 15 per cent, plus 3.84 per cent tax on all oil exported. They also agree to improve hygienic conditions, and the Soviet government allows important tax exemptions and importation of supplies free of duty.

## London Letter

By W. A. Doman  
Special Correspondent

### West Rand Consolidated Plans to Refinance—Avino Mines Again to the Front

#### Rift in Russian Manganese Monopoly— Nigerian Base Metals Corpora- tion to Double Production

London, Nov. 24.—Some good financing has been undertaken in the city recently, the two main instances being in connection with West Springs, Ltd., and West Rand Consolidated Mines, Ltd., both Transvaal mining companies. The former has a fairly large debenture issue outstanding, which the directors have power to repay either by drawings or purchase in the market, and a few days ago a plan was announced for their redemption. New shares are to be issued with this object, and also to carry out an intensive development program to ascertain whether an increase of the treatment plant would be justified. As usually happens, holders who sold their debentures at under redemption price (£105) complain that the company has bought the debentures, but this it was entitled to do and save on redemption.

The West Rand Consolidated Mines has formulated a plan for the reorganization of the capital, and intends to issue 2,000,000 new shares of 10s. each, the whole issue being guaranteed by the General Mining & Finance Corporation. In the last few months, developments on the West Rand Consolidated have been so favorable that the whole character of the undertaking has changed, and it now appears to have become a great mine. When the public would not look at the shares at about 7s. or 8s., the General Mining & Finance Corporation stood by its subsidiary and financed it, and as the price recently has been around 15s. the Corporation must have made a handsome profit on its operations—an inference borne out by the fact that its own shares have risen from something like 12s. 6d. to 32s. 6d.

Sir Abe Bailey, of South Africa, who now controls the Nigerian Base Metals Corporation, has acquired the Niger company's mining rights in Nigeria. This makes the Nigerian Base Metals Corporation the largest mining company in that country. According to the technical adviser, an output of 200 tons of tin concentrates monthly is possible by March next, and it is hoped to double that rate in due course. Although the exact consideration for the Niger company's interest has not been stated, it is suggested that a sum of approximately £400,000 is involved.

Some time ago I referred to a report issued by the committee of shareholders of the Avino Mines, which accused the directors of gross mismanagement. The directors have now issued a reply, and deal *seriatim* with the allegations made in the circular of the committee. From this it would appear that throughout, the directors were influenced by the technical man-

agement on the spot. All of the facts, apparently have not come to light, and no one cares to say who is or was the responsible party. In any case the directors are fairly certain to get support from the shareholders, seeing that the committee appointed to confer with the board has never met the directors.

There seems to be a rift in the lute where the Soviet manganese monopoly is concerned. It was imagined when the Harriman group concluded its agreement with the Soviet government that it would have a monopoly, and the terms of payment and output were arranged accordingly. It now appears that what was reported, or suggested, to be a manganese deposit of minor importance in Ukraina was omitted from the agreement, and is proving to be so large as seriously to threaten the profitable working of the Harriman concession. The working of the Ukrainian deposit has been awarded to a German company, and it is expected that the Harriman group will find it difficult to pay the royalties of \$3 per ton on 800,000 tons of manganese ore per annum, for this has to be paid whether the tonnage is exported or not.

### Friction Between Georgian Manganese Co. and Soviet Russia Denied

Reports are current that there is friction between the Georgian Manganese Co., Ltd., and the Soviet government, due to the latter operating manganese deposits not included in the Harriman Concession. This has been refuted by J. S. Elliott, vice-president of the Georgian Manganese Co. Ltd., by a published letter in which he says: "Neither the Georgian Manganese Co., Ltd., nor W. A. Harriman & Co., Inc. (of which I am also a vice-president), has made a complaint or intimated that there was any friction with the Soviet government. Quite on the contrary, the Soviet officials have given to the managers of our property every possible co-operation.

"From this you will see that the information in the article is not based on a foundation of fact and, in order to clarify the situation, we are writing you this letter in the hope that you will give it the same publicity as was given to the original article."

### Brazilian Manganese for Export

The Companhia Brasileira de Mineraes of Rio de Janeiro, Brazil, with manganese mines at Bomfim, State of Bahia, announces that it is now in a position to export manganese ore.

### Early Development of Mica Property, Bancroft, Ont.

An English syndicate has purchased the mica property owned by Orser & Wilson, near Bancroft in Hastings County, Ont. It is understood that a refining plant will be erected and active operations begun soon by the purchasers. The sale was brought about by a publicity campaign undertaken by Hastings County.

## Johannesburg Letter

By John Watson  
Special Correspondent

### Transvaal Gold Production 802,059 Oz. for September— Komati United Mines May Resume Early in 1926

Johannesburg, Nov. 3.—The total mineral production of the Union of South Africa for September was £4,591,259, of which £3,406,930 was gold and £734,275 diamonds. The producing gold mines of the Transvaal employed 19,995 whites, the large mines of the Rand employing 19,413 of this number. A record low mark will be registered for expenditure on non-producing mines this year, the figures for August showing only 10 white men and 31 natives at work on non-producing properties. No new ventures are being developed and equipped which will compensate for the closing down of older properties.

The quarterly report of the directors of Transvaal Platinum, Ltd., up to Sept. 30, was recently issued. Rietfontein main shaft was then down 71 ft. and Welgevonden main shaft, 51 ft. Each shaft has been equipped with a very substantial wooden headgear, with collar sets and doors; also with a portable steam hoist and sinking buckets. During the past quarter, a total of 818 ft. of drives, winzes and crosscuts has been recorded. Good progress is being made with the construction of the mill and reduction plant.

The managing director, E. Lyertwood, has published a report of work done on the Komati United Mines up to Sept. 30. It was necessary to construct two drifts on the Komati River and partly to remake 16 miles of road. At first, it was found difficult to obtain a sufficient supply of native labor, only forty Swazies being obtained from fifty kraals. In the old sulphide mine all levels had to be cleaned out and secured, owing to falls of ground. The gold obtained from the sampling to date fully bears out the high values shown on the assay plans of the old company. Certain samples from this mine were assayed, years ago, in London, by the late Sir William Ramsay.

On the Johannesburg Stock Exchange, during the last week, there was a good deal of selling from London for French account, owing to the fall in the franc. Gold shares were irregular. Land and platinum shares also fluctuated daily. T. C. Lands rose from 70s. 3d. on Monday to 77s. 3d. on Saturday, with, however, considerable fluctuations.

### New Hospital for United Verde Copper Co.

The United Verde Copper Co. will erect a new \$250,000 hospital at Jerome, to take the place of the old structure which has been in use for several years, which, because of a land fault, is gradually sliding down a steep hill. Work will be started the latter part of January following the opening of bids and the awarding of contracts.



## Situation at the Mines

By Albert H. Fay

Assistant Editor

**DEMANDS FOR IRON AND STEEL** have had a stimulating effect on the iron industry, resulting in larger shipments than ever and a continuance of Lake traffic to the end of November, thus making two records—tonnage and length of season. Other base-metal mines have continued active, especially lead and zinc. In most of the districts there has been ample labor, but in the older camps of Colorado a dearth of experienced miners is reported. There are many indications of a continuation of the revival now felt in Mexico.

Average Metal Prices, June-November, 1925

Period	In Cents			
	Copper	Lead	Zinc	Silver
June.....	13.399	8.321	6.990	69.106
July.....	13.946	8.151	7.206	69.442
August.....	14.490	9.192	7.576	70.240
September.....	14.376	9.508	7.753	71.570
October.....	14.300	9.513	8.282	71.106
November.....	14.353	9.739	8.614	69.223

**Copper**—There were a number of sales of property and also a number of mergers under consideration. The Ducktown Sulphur, Copper & Iron Co. was sold to the Ducktown Chemical & Iron Co., the new company planning to produce iron sinter. The mergers of the Nevada-Ray and the Shattuck-Denn properties were delayed by suits filed in the court to prevent the two mergers. The Metal Exploration Co., of New York and San Francisco, sold all of its holdings, including the Flin Flon copper property in Manitoba. The Anaconda Copper Mining Co., of Montana, and the W. A. Harriman Co., of New York, have now become factors in European affairs in that a controlling interest has been obtained in the Giesche zinc mines of Silesia.

The Calumet & Arizona Copper Co. made its first shipment of cement copper from the underground precipitation plant for the recovery of copper in mine waters. In the Lake Superior district there is no surplus of copper at the mines, and mine labor is returning to the copper country from the industrial centers. Refined copper production in the Michigan district in November is estimated as 13,750,000 lb., of which Calumet & Hecla produced 8,200,000 lb. as follows: Ahmeek, 2,500,000; Conglomerate and Osceola lodes, 2,750,000; North Kearsarge, 400,000; Tamarack reclamation plant, 800,000; and Calumet reclamation plant, 1,750,000. Estimated outputs of other mines are: Quincy, 1,250,000 lb.; Mohawk, 1,500,000; Copper Range, 2,000,000, and Isle Royle, 800,000. The Calumet & Hecla Mining Co. is completing the installation of mine equipment on the 81st level preliminary to deeper mining. Magnetic surveys in Canada and electrical prospecting in Rhodesia are reported as having discovered new copper-bearing orebodies. A. S. & R. Co. has applied for permission to reopen the Carson patent suit. The Spassky Copper Co., of Siberia, has offered a new stock issue to the public preliminary to the resumption of operations next year.

Granby Consolidated Mining, Smelting & Refining Co. and Britannia Mining & Smelting Co. of British Columbia are working their plants at capacity. Allenby Copper Corporation is slow in bringing its mill up to its rated capacity of 2,000 tons per day. As yet only one copper furnace of the Consolidated Mining & Smelting Co. is in operation. This is treating Allenby concentrate and residues from the dismantling of the Canada Copper Corporation's old plant at Greenwood and the Granby company's old smelter at Grand Forks. It is announced that Mason Valley Mines Co., in Nevada, will resume operations before Jan. 1, now that its 1,000-ton flotation plant is completed.

**Lead**—The British Lead Manufacturers' Association has purchased a German chemical works at Hamburg, Germany, for the manufacture of lead oxide. American Metal Co. plans to build a lead smelter at Zacatecas, Mexico. Potosi Mining Co. has completed a mill at Santa Eulalia. Many other plants are under construction in the southern republic, and still more are being planned to keep pace with the demand for lead, zinc, and silver.

**Lead-Silver**—American Metal Co. has secured control of a large area in Summit County, Colo., for the development of complex ores. Park County, Colo., shows renewed

activity, with considerable development in progress. Ophir Hill mine has suspended operations, and, being the last producing mine in the Ophir district, Utah, marks the passing of the district, which was discovered in 1865. Bingham Mines, of Utah, are earning \$9 per share. Coeur d'Alene mining companies have adopted a new sliding wage scale based upon the price of lead.

Important news of the month reports the acquirement of a controlling interest in National Silver Mines, in British Columbia, by the Sebakwe Corporation, of London, which appears to be an offshoot of the Selukwe Mining & Finance Co., and the acquirement of an option and lease on the Goodenough property, near Ymir, B. C., by the Porcupine Goldfields Development Co.

**Zinc-Lead**—The zinc-lead mines of the Joplin-Miami district had 170 mil's in operation in November, with a dozen new mills under construction. The Giesche zinc mines, in Silesia, are now undergoing a thorough examination by engineers of the Anaconda Copper Mining Co., which recently acquired control of these old properties. Utah-Apex Mining Co. has installed a concentrating plant for the treatment of its complex zinc-lead ores. Consolidated Mining & Smelting Co. is operating its lead and zinc plants nearly at capacity.

**Gold**—Transvaal gold production is normal, with approximately 800,000 oz. per month. California miners are agitating for a change in the method of taxing mines, claiming that gold mines suffer unjustly. Revival in Colorado is due largely to the ability to treat complex ores with new metallurgical processes, thus saving zinc, which was a detriment only a few years ago. Fairbanks, Alaska, is the most active district in the territory at present, and small shipments of lead-silver ore are being made from Hyder. A freighting road has been completed to the new Quebec goldfield, so that mining equipment may be brought in during the winter. About 3,000 prospectors and laborers are in the new gold district, the majority of whom will find plenty of work during the winter. The new camp at Gilbert, Nev., is making small shipments, but no large mines are in immediate prospect. The first arrest of high-graders in California under the new law which prohibits this practice was made in November and the accused are to stand trial. Yuba Manufacturing Co., of San Francisco, is building five dredges for use in the platinum mining district of the Ural Mountains, Russia, the first shipment having already been made. Announcement was recently made of the dismantling of the last dredge in the Yukon Territory by the Yukon Gold Co. and the transfer of this equipment to the Malay tin mines.

In Nevada, the Comstock Merger production continued about the same as in October, 35,000 tons, having a value of \$165,000. The White Caps company cut the east orebody on the 1,220 level, exposing 5 ft. of high-grade, free-milling gold ore, resulting in much claim activity in the district. At Tonopah, the production rate remained unchanged, with a total for November estimated at \$250,000.

**Iron**—The Tennessee Charcoal Iron Co. sold its mine and smelter, both of which have been idle since the war. It is understood they are to be opened at an early date. The Minnesota iron companies have contested the occupation tax and the royalty owners have appealed in the royalty tax cases. Ore shipments from the Lake ports for the season just closed amount to about 53,000,000 tons. Underground mining will be continued all winter in the iron mines.

**General**—Golding & Sons Co., of Trenton, N. J., has acquired the holdings of the Erwin Feldspar Co., in Tennessee and the Carolinas. The Colombian Government has issued permits to develop certain platinum-bearing areas. Prospecting for platinum in South Africa has continued unabated. The Mond Nickel Co. has completed a new sulphuric acid plant at Coniston, Ont. Canadian Asbestos Co.'s merger is still pending, with prospects of completing the transaction at an early date. In Mexico there is an extensive program of road building, which will stimulate mining in the more remote districts. In fact, there is great activity in nearly every state in Mexico.

## Societies, Addresses, and Reports

### President Coolidge Pledges Aid To Mining Industries

**I** REGRET that plans previously made will not permit me the pleasure of attending the annual banquet of the American Mining Congress upon the occasion of its twenty-eighth annual convention.

In view of my inability to be present in person on this occasion, will you be good enough to extend to the assembled delegates my personal greetings and my hope that their united efforts may make of this convention an outstanding success, notable among the achievements which have marked the progress of your organization. It is only by such co-operative effort as your organization typifies, that the vast and intricate problems of modern industrial development can be successfully solved. In your hands lies the guardianship of the great mineral resources of the nation, and, in a large measure, the responsibility for the efficient and economical conversion of this natural wealth into the innumerable finished products which so materially contribute to the wealth and

prosperity of all the people. I am convinced that you are, individually and collectively, conscious of the duty which rests upon you not only to conserve these great natural resources of the nation, but to strive also to lessen the hazards to human life and safety in the recovery of the mineral wealth of the country for the use of its inhabitants and to seek still greater improvements in production methods and in the elimination of waste, to the end that lowered costs may increase the wider use of the products manufactured from our basic mineral commodities.

It is through the earnest, united and unselfish labors of the men comprising such organizations as yours, that the eventual solution of the large economic problems of industry will be achieved, and, so far as lies within its power, the executive arm of the Federal Government is ready and willing to lend its aid in this work.—Message of the President to diners at the annual banquet of the Mining Congress at Washington on Dec. 9.

### Spokane Organizations Have Campaign for Mine Legislation Against "Blue Sky"—For Lower Incorporation Fees and Larger Appropriations for Roads and Geological Work

The Northwest Mining Association and the Bureau of Mines of the Spokane Chamber of Commerce are making a united and strong effort for five distinct matters which they consider of great importance to the mining industry. They are fighting once more to prevent the legislature of Washington from applying "blue-sky" legislation to the mining industry; they are urging the legislature to appropriate \$50,000 for geological, topographic and hydrographic work in the next year; they are fighting with other organizations to prevent the abridgment of the rights of prospectors on such part of the public domain as may be leased; they are urging the Washington Legislature to repeal the law which charges heavy fees for the incorporation of companies engaged in mining; and they are urging a continuation of federal aid for Western highways which will greatly facilitate mining.

Many mining companies which formerly were incorporated under the laws of Washington have gone to other states or out of the United States because, it is said, of an amendment to the state law passed a few years ago increasing the fee for the incorporation of mining companies, to a graduate scale so that in some cases it now costs as high as \$500 to incorporate besides

heavy annual fees. Mining men desire this amendment repealed so that the old fees of \$25 for filing articles of incorporation and an annual fee of \$15 shall again prevail.

Federal aid for Western roads is considered of great importance to mining, for many promising mining districts can be reached only by traversing large districts which the government has withdrawn for forest reserves, leaving a condition which makes it impossible for states to provide adequate highway facilities into these mineral regions. Eastern people who are inclined to object to the expenditure of federal money on Western roads are reminded that these highways are needed in many cases to bring raw products of the Pacific Coast to tidewater for shipment to the trade and factories of the Atlantic seaboard.

L. K. Armstrong, secretary of the Columbia section of the American Institute of Mining and Metallurgical Engineers, said at the last meeting of the Mining Bureau that it was reported that Governor Roland Hartley, in his zeal for economy, proposed to appropriate only \$2,500 for the geological and hydrographic work. In speaking of his resolution for an appropriation of \$50,000 a year, Mr. Armstrong said:

"It is time to stop compromising with men on the outside who are knocking the mining industry, and we ought no longer to permit other people or interests to run the mining industry into the ground. We need \$50,000 for this work in Washington and if we come out squarely for it perhaps we will get it."

A resolution advocating an annual expenditure of not less than \$50,000 for this work was passed.

The following resolution was adopted at the same meeting against the abridgment of the right to prospect on any of the public domain which may be leased to livestock men:

"Resolved: That should a bill to lease the lands on the public domain be introduced in the United States Senate as the result of the investigations of the Public Land Committee of the Senate, we request that such bill provide that the right to prospect and locate mining claims on such leased land on the public domain be not abridged. Further, that the right of ingress and egress to any mining claims located prior to the leasing of such land on the public domain be not abridged and that the right of ingress and egress to any mining claims located on any leased land on the public domain subsequent to the leasing of such land on the public domain, be not abridged."

### Petroleum Institute Announces Rockefeller Fund for Oil Research

John D. Rockefeller has pledged a fund of \$250,000 to the American Petroleum Institute "for the initiation of a program of scientific research in petroleum," according to a report made on Dec. 5 by the American Petroleum Institute. The fund is to be available in annual installments of \$50,000 for five years, and to be expended "primarily in supporting research fellowships in scientific institutions—the recipients of such fellowships to engage in research on some problem of the physics, chemistry, or geology of petroleum oil"; and the results of the work are to be made "freely available to the industry and public generally."

The purpose of this program is not merely to secure the carrying on of a limited amount of scientific research by specially engaged workers, but rather to utilize this means to enlist a more general scientific interest in petroleum. It is therefore left to the discretion of the committee administering the fund to employ it not only for the direct support of research but in any other manner which will accomplish Mr. Rockefeller's major purpose.

Mr. Rockefeller recommends that the fund be administered by a committee consisting of Messrs. J. C. Donnell, Walter C. Teagle, and Robert L. Welch, all directors of the American Petroleum Institute. Mr. Donnell is president of the Ohio Oil Co.; Mr. Teagle is president of the Standard Oil Co. of New Jersey; and Mr. Welch is general secretary and counsel of the Institute.

The board of directors of the Institute, in announcing the gift, expressed their appreciation of Mr. Rockefeller's continuing interest in the practical problems of the industry. It was stated that the plan for administering the fund would be worked out by the committee named, in consultation with the board of directors, with government officials concerned with the industry, and with educators, scientists, and technicians.



## Men You Should Know About

**Arthur W. Jenks**, mining engineer, of Berkeley, Calif., is in New York.

**J. Parke Channing** has been inspecting the mining operations of the Miami Copper Co.

**Charles W. Clark**, accompanied by Mrs. Clark, is making an extended visit to the United Verde Copper Co. in Jerome.

**T. J. Donoghue**, first vice-president of the Texas Company, has returned to Houston, Tex., after spending several months in New York.

**W. C. Brewer**, of New York, general manager of the crude-oil department of the Vacuum Oil Co., was in Houston, Tex., recently on business.

**A. W. Newberry**, mining engineer, is expected to return to New York from South Africa about the middle of December. Mrs. Newberry accompanies her husband.

**H. A. Kursell**, a native of Russia and a geologist of world-wide experience, is now connected with the Federal Mining & Smelting Co., with headquarters at Wallace, Idaho.

**Victor C. Alderson**, formerly president of the Colorado School of Mines, has opened offices in the Symes Building, Denver. He will devote his attention to the oil-shale industry.

**Walter A. Schmidt**, president and general manager of the Western Precipitation Co., has been in Europe on a business trip and expects to return to Los Angeles early in December.

**Gordon Campbell**, accompanied by **Thomas Hoatson**, **T. F. Cole**, **Tom Collins**, and **George Newett**, is visiting the properties of the Calumet & Arizona, New Cornelia, and Verde Central.

**Nelson L. Dickerman**, of San Francisco, is en route to Buenos Ayres to make an examination of placer properties in South America for the WAD Syndicate. The work will require several months.

**H. R. Robbins** has returned to the United States from an absence of over three years in Australasia, British India, Netherlands India, and the Far East, in the interests of the American Cyanamid Co.

**L. R. Robbins**, for some time superintendent at the Belmont mines, Tonopah, has gone to Wickenburg, Ariz., to direct development at a property there recently acquired by the Tonopah Belmont company.

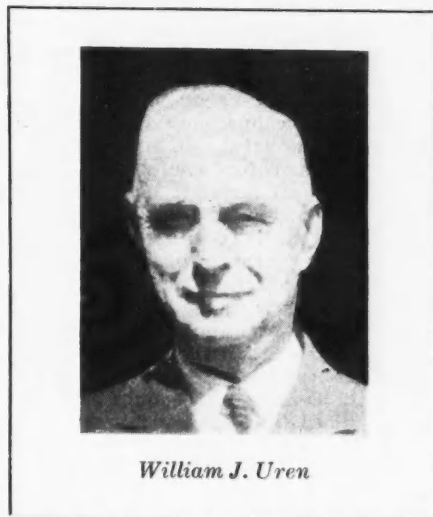
**D. P. Wardwell**, of Houston, Tex., petroleum engineer for the Humphrey Oil Corporation, has resigned to accept the position of petroleum engineer with the U. S. Geological Survey. Mr. Wardwell will be stationed at Casper, Wyo.

**J. B. Tyrrell**, managing director of Kirkland Lake Gold Mines, Ltd., has sailed for England, to lay before his principals, the Anglo-French Exploration Co., first-hand information about the important new discoveries on the property.

**Norman C. Stines**, general manager of the Fairbanks Exploration Co., a

subsidiary of the U. S. Smelting & Mining Co., recently left Fairbanks, Alaska, en route to Boston to confer with officials regarding operations for next season.

**Henry A. Wentworth** and **Howard Clark Davis**, of the WAD Syndicate, of Boston and Winnipeg, sailed on Dec. 2, on the "Aquitania," for a conference in London with John Taylor & Sons, who are associated with the Syndicate in Manitoba mining developments.



William J. Uren

**L. C. Penhoel**, president of the Southwestern Engineering Corporation, is in Joplin, Mo., in connection with the starting of the flotation plants of the Good Eagle, Mary Jane, and Queen Esther mills. The flotation equipment was furnished and installed by the Southwestern Engineering Corporation.

**Prof. J. A. Newcombe**, of Liverpool University, has arrived at the University of Toronto, Canada, to take over the duties of Professor Ellis in the department of metallurgy, Faculty of Applied Science and Engineering. Mr. Newcombe is a graduate of the Royal School of Mines, London, from which he received the diploma of Associate of the School, in addition to which he was granted the degree of B.Sc. in London University.

**Dr. Francis A. Thomson**, dean of the School of Mines, University of Idaho, **Rush J. White**, **Fred W. Callaway**, and **George R. Trask**, mining engineers of Wallace, Idaho; **L. K. Armstrong** and **J. M. Porter**, mining engineers of Spokane, Wash., and **Otto A. Weile**, hydraulic engineer of Spokane, all appeared recently as expert witnesses in the case of the Copper Giant Mining Co. vs. the Clarinda Mining Co., in the federal court at Coeur d'Alene, Idaho. The question involved was the alleged drainage of a small creek on the property of one of the litigants near Clark's Fork, Idaho, by reason of a trespass tunnel driven by the other litigant. The court denied the plaintiff damages, but granted a permanent injunction against further trespass by the defendant because of his failure to establish an extralateral right.

### An Appreciation of William J. Uren

William J. Uren, of Houghton, Mich., general manager of the Seneca Copper Company, who died suddenly in his office at the mine the morning of Nov. 6, of cerebral hemorrhage, had been identified with the Michigan copper mining industry for forty-five years. He was considered one of the district's ablest engineers and executives. The last eight years of his life were spent in the development of the Seneca property, and his death found this mine on the eve of resumption of production after a period of reverses which required refinancing. He sunk both the Seneca and Gratiot shafts, which are extensively opened on the Kearsarge lode and in which the copper showing is said to compare favorably with other mines on this vein. Mr. Uren was a keen student of problems peculiar to the district, and ingenious both in method and constructive ability. Many of his ideas and innovations have been carried out in Seneca. He was a firm believer in concrete and steel lined shafts, and followed this plan in both the Seneca shafts. Seneca shaft is sunk for a distance of 1,320 ft. vertically, from which point it continues on a curve which cuts and passes through the Kearsarge lode at about 1,650 ft. in depth. Mr. Uren devised a skip which would remain upright in making the curve in the shaft, and the morning death overtook him a man car that he had designed to meet similar conditions was tested and pronounced a success. At Gratiot shaft he built a rockhouse cylindrical in design, which he introduced at Ahmeek while in charge of that property under the Bigelow management. Before entering the Michigan College of Mines at Houghton, from which he was graduated in 1888, Mr. Uren was associated with his father, the late Captain Richard Uren, a pioneer mining man of the district, at the Lake Superior Native Copper Works and at the Wolverine mine, which was opened by his father and T. W. Edwards, of Houghton. After his graduation from the mining college, Mr. Uren was engaged by the government in work on the Lake Superior Ship Canal and in 1899 he became assistant superintendent of the Trimountain and Elm River mining companies. In 1903 he was made manager of the Bigelow interests in the district, taking charge of the Tamarack, Osceola, and Ahmeek properties. During this time he opened every shaft of the Tamarack Mining Co., effecting many remarkable economies in surface and underground work at the mine. Mr. Uren was married Oct. 5, 1895, to Miss Emma Lucia Forbes. The widow and four children survive. They are Richard F., who was associated with his father at the Seneca mine; William J., Jr., of the United Verde Mining Co.; Mary Eva, at home; and Alice Margaret, a student. Mr. Uren was a member of Houghton Lodge, F. & A. M., Houghton Chapter, R. A. M., Palestine Commandery, Knights Templar, Houghton, and the Houghton Chapter of the Eastern Star. The funeral was held at Houghton under Masonic auspices.

## Recent Technical Publications

Reviews, Abstracts, and References

### Why the Salesman Sells

**The Psychology of Selling and Advertising.** By Edward K. Strong, Jr. McGraw-Hill Book Co., New York. Price \$4.

Although the theory of this volume may seem far removed from the domain of mining, yet it has a certain bearing, since the problem of selling and competition is affecting the development of mining industries, as well as of all others. Therefore, the reading of treatises like this, which, to be sure, are primarily intended for the commercial salesman, can hardly help being broadening, while at the same time they are a source of interest and even amusement. For one thing, the study will enable the reader, as a buyer, to diagnose correctly the thoughts and the calculating inspection with which the salesman of bonds or clothing looks him over, as cold-bloodedly as does the surgeon who is about to take out his appendix; for all these lesser salesmen study the psychology of salesmanship and the wholesale salesmen do it also. A most successful master peddler of mining stock told the reviewer that he made a study of selling psychology and that he counted on the fundamental instinct of greed. Events have shown that his calculations have been correct. And Joseph P. Day, a widely known and successful real estate auctioneer and operator, recently told a class in advertising how he sold Judge Gary the skyscraper which the Steel Corporation has just bought as a permanent home in New York, by noting the fondness of the Judge for the uninterrupted view of the harbor from his window, touching diplomatically upon that nerve at the proper moment. Although the tactics taught the salesman may seem to the uninitiated Machiavellian at times, since they are in large measure cold-blooded devices to get beneath his armor of caution, and accomplish the financial benefit of the salesman, yet actually these principles and these studies are rife, and it is well to be educated in a broad way and be up to the minute; for, in the welter of selling, the mining man, engineer or otherwise, has got to sell something skillfully, just as things are being sold skillfully to him. It is the fashion to recognize this fact, and to indulge in trials of skill and the matching of psychological weapons. The modern prospect gleefully invites you to sell him your idea if you can; and so it is up to you to play with him the particular game which he knows and enjoys.

J. E. SPURR.

**Mining Garnet — Compressed Air Magazine** for December (11 Broadway, New York; price 35c.) contains a six-page illustrated article describing the operations of the Barton Mines Corporation, operating a garnet mine and mill three miles from North River, N. Y. The mill is handling 250 tons of ore daily; it was put in operation in August, 1924.

**Michigan Maps**—Preliminary copies of geological maps of the Michigan copper district, one of the results of the work of the geological corps of the Calumet & Hecla Consolidated Copper Co. and its continuation by the U. S. Geological Survey, have been distributed to the mining companies, engineers and other individuals in the district who have contributed data. Criticism and corrections are requested of those qualified to check over the maps before the final edition is published. The hope is expressed that the recipients will comply as far as possible, inasmuch as the original information which goes to make up the maps cost the Michigan copper mining companies millions of dollars. It probably will be many years before another geological survey of the district is made, and by that time much of the information which was compiled and assembled from the original sources will be no longer available. Therefore it is desirable that the maps be made as accurate as possible. The preliminary maps are on a scale of 500 ft. to the inch, and they include the country from the Victoria mine, in Ontonagon County, to the Seneca mine, in Keweenaw County. The final maps will be published on a smaller scale and will include the country from the Cass property, southwest of the Victoria, to the end of Keweenaw Point. They will be accompanied by a report which will be available for general distribution. The report will deal with the geology and ore deposits of the region. The preliminary large-scale maps will be found convenient in planning exploration, the principal purpose of the Calumet & Hecla company in conducting geological research work over a period of several years.

**Canadian Geology**—A report by Dr. W. H. Collins on the geology of the north shore of Lake Huron has been published by the Geological Survey of Canada. It presents the results of a detailed examination of the lithological, structural, and stratigraphic features of the Pre-Cambrian rocks underlying the area and of the age relations of the different systems. The section of country studied includes the type Huronian area, and the report will consequently prove of interest to students of Pre-Cambrian geology. Descriptions are also given of the deposits of gold, copper, and other economic minerals. Copies of this report may be had on application to the Director of the Geological Survey, Ottawa, Canada.

**Manitoba**—"The Mineral Resources of Manitoba," by R. C. Wallace, has been issued by the Industrial Development Board of Manitoba, Winnipeg, from which it may be obtained on request. Occurrences of the various metals and non-metallic minerals found in the province are discussed briefly, and a large map is appended, on which the location of known mineral deposits is indicated in red. A bibliography on the economic minerals of Manitoba is included.

**Arizona Geology**—Bulletin 771 of the U. S. Geological Survey, Washington, D. C., is entitled "Ore Deposits of the Saddle Mountain and Banner Mining Districts, Arizona." Nearly thirty mines and prospects are described, the deposits including lead-silver veins, pyritic gold deposits on shear zones, disseminated pyrite, and contact-metamorphic deposits. The bulletin, which is of 72 pages, with colored geological maps, is by Clyde P. Ross, and may be obtained for 25c. from the Superintendent of Documents, Washington, D. C.

**Mining Publications**—A new quarterly mining publication has been launched in Germany, printed partly in English but chiefly in German, which aims to cover the economic side of mining from the international viewpoint. The first issue was that of October. The title of the newcomer is *Internationale Bergwirtschaft*, published by C. L. Hirschfeld, 10, Hospitalstrasse, Leipzig, Germany, and the subscription price will be \$5 per year.

**Department of Commerce**—The thirteenth annual report of the Secretary of Commerce, for the fiscal year ended June 30, 1925, has recently been issued. It may be obtained for 20c. from the Superintendent of Documents, Washington, D. C.

### Patents

**Amalgamator**—No. 1,562,775. Nov. 24, 1925. C. C. McBride, Sanger, Calif. A rotatable porous cylinder lined with an amalgamated screen, and containing a spiral device for conveying ore from the inlet to the discharge. Portions of the cylinder may be submerged in an electrolyte solution.

**Grinding Mills**—Nos. 1,562,791-2. Nov. 24, 1925. J. P. Ruth, Jr., Denver. These patents cover the design of liner and baffle plates at the trunnions of ball mills.

**Treating Mn-Ag Ores**—No. 1,562,942. Nov. 24, 1925. M. F. Coolbaugh and J. B. Read, Golden, Colo., assignors to The Complex Ores Recoveries Co., Denver. Sulphide ores of silver and manganese are roasted for such a length of time and at such a temperature as will drive off the sulphur from sulphides other than silver sulphide, and at the same time prevent a dead roast. The minerals and gases are advanced together, and the temperature is then lowered below the decomposition temperature of manganese sulphate.

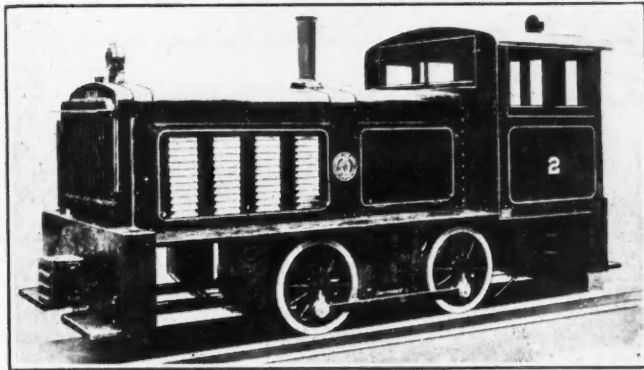
**Dry Concentrator**—No. 1,563,238. Nov. 24, 1925. A. H. Stebbins, Los Angeles. A system of dry concentration including inclosed concentrating tables, fans, conduits, and dust collectors.

**Roaster**—No. 1,563,616. Dec. 1, 1925. A. D. H. L. Fassotte, Lommel Usines, Belgium, assignor to Cie. des Métaux Overpelt-Lommel, Société Anonyme, Overpelt-near-Neerpelt, Belgium. A roasting process using no extraneous fuel, in which the ore particles are held in suspension.

**Gold Precipitation**—No. 1,563,957. Dec. 1, 1925. W. H. Bates, Los Angeles. An apparatus for the recovery of precious metals from solutions, embodying a mercury cathode and anode.



## New Machinery and Inventions



*12-ton worm-gear-drive gasoline locomotive equipped with 100-hp. motor*

### New 12-Ton Gasoline Locomotive Introduced

Announcement has been made that another addition has recently been made to the Vulcan Iron Works line of worm-gear-drive gasoline locomotives. This is a 12-ton model, known as Class EW-12. The locomotive is similar in general design and construction to the other worm-drive machines that this firm has been building in recent years.

Among the outstanding features of these locomotives are cast-steel frames, steel-tired wheels, worm drive on rear axle, side connecting rods (no chains, no sprockets), and constant mesh transmission gears.

The 12-ton model is equipped with a 100-hp. Waukesha motor with Ricardo head. The transmission is designed for four speeds forward and four equivalent speeds in reverse, ranging from 2½ m.p.h. in low gear up to 12 m.p.h. in high. The drawbar pull in high gear is 2,275 lb. with a starting force in low of 7,200 lb.

The locomotive is built in all the prevailing track gages and can be adapted to any class of haulage service. It is particularly suitable, however, on account of its power and sturdiness, to take care of standard-gage switching. The standard-gage model of this size has one very exclusive and admirable feature in the spring draft rigging which is furnished in the bumpers with M. C. B. automatic couplers. This rigging is designed so as to take up in the bumper all the shocks of coupling with the strains of pulling and pushing railroad or other heavy cars. In this matter the motor and other working parts are protected and long life is assured.

### Magnetic Switch Weatherproof

A special form of the type CR-7009 magnetic switch made by the General Electric Co. is provided with a weatherproof inclosing case and roof for use in valve-control service where operating conditions require that the switch be located in an exposed place, or in other similar conditions where it is necessary or desirable to locate the control nearer the motor.

All seams and supports of the outside case are turned, to eliminate surfaces where water might collect. The roof is slanting and overhangs the case

on all sides to allow water to fall away. The case itself is provided with a special finish to meet the service conditions.

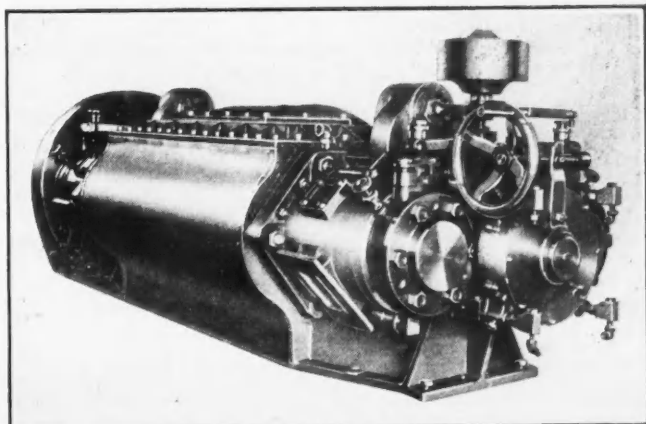
### Stronger Bearings Now Made

Greater strength has been put into the bearings produced by Standard Steel & Bearings, Inc., by a recent change. Balls were previously made of chrome alloy. Now they are all made of molybdenum steel. This was done not only to give the balls the toughness of armor plate, but also because molybdenum is the only alloy that can be put into steel in an absolutely pure state.

### Crankless Engine Displayed at Power Show

Among the numerous displays at the "Power Show," held last week in New York City, a new type of oil engine was exhibited by the Crankless Engine Co., Inc., 29 Broadway, New York. It employs a swash or wobble plate keyed to the shaft at an acute angle. The cylinders are placed parallel to the shaft, and the pistons, which are in pairs, bear against the wobble plate through a special type of thrust bearing. Combustion in the cylinder reacts on the piston and wobble plate, and the component of the thrust tangential to the shaft causes the latter to rotate. Owing to the special bearings used, the friction losses are low. This engine uses high compression, employing oil for fuel, and is adaptable to marine and vehicular drives. The machine displayed is shown in the accompanying cut.

*Four-cylinder crankless engine of novel design*



### Trade Catalogs

**Feed Pumps**—Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has issued an eight-page catalog on centrifugal boiler feed pumps. It is No. 2082.

**Magnetic Pulleys**—Bulletin 31 of the Magnetic Manufacturing Co., Milwaukee, Wis., covers the company's new "high-duty" magnetic apron pulley.

**Roller Bearings**—"Dimension and Load Bulletin No. 1559," covering Hyatt roller bearings for industrial equipment, has been received from the Hyatt Roller Bearing Co., Newark, N. J. It contains 14 pages.

**Hardening Furnaces**—Automatic & Electric Furnaces, Ltd., 173 Farringdon Road, London, E. C. 1, England, has issued a catalog of Wild-Barfield electromagnetic steel hardening furnaces. The theory of electromagnetic hardening is dealt with and operating costs are given.

**Laboratory Apparatus**—Empire Laboratory Supply Co., 218 East 37th St., New York, has issued separate catalogs covering its Jena filter glass apparatus and Empire graduated volumetric glass apparatus.

**Turbines**—Bulletin GEA-235 of the General Electric Co., Schenectady, N.Y., covers the company's 500-, 600- and 75-kw., 5-stage, 60-cycle steam turbines.

**Flow Meters**—Bulletin GEA-133, of the General Electric Co., covers G-E flow meters, electrically operated for measuring steam, water, oil, and gas.

**Engines**—The Climax Engineering Co., Clinton, Iowa, has issued a series of bulletins covering the engines which it makes. Bulletin "A" describes the "K" series, four-cylinder 5 x 6½-in. engine. Bulletin "B" covers the "T" series, four-cylinder, 5½x7-in. engine. Bulletin "C" describes the "R" series engine, which is made in two models—model R4U covering the four-cylinder, 6x7-in. engine and model R6U covering the six-cylinder, 6x7-in. engine. These engines develop power ranging from 35 to 130 hp. Bulletin "D" covers the "K" and "T" series of portable power houses which are designed for operating hoists, mine ventilators, power pumps, generators, and similar equipment.

**Rock Drills**—The Colonial Steel Co., 324 Fourth Ave., Pittsburgh, Pa., has issued a "Rock Drill Book," containing useful information on the manufacture and heat treatment of drill steel. It has 36 pages.

# The Market Report

## Record Volume of Copper Sales Features Metal Market

**Bulk of Business at 14c. Delivered—Smelting Company Cuts Lead Price—Zinc and Tin Somewhat Higher**

New York, Dec. 9, 1925.—Except for copper, business in the non-ferrous metal markets during the week ended today has been of modest proportions. The volume of copper sales has been larger than in any week for many months, the ruling price being 14c. delivered, with some transactions bring-

ing up to 14.125c. for Eastern delivery and 14.25c. for the Middle West. The lead market declined largely in sympathy with the weakness in London, whereas zinc is a trifle stronger, due particularly to a squeeze for metal for prompt shipment. Silver and tin are steady.

### Copper Market Active

After several weeks of dull business, copper sellers and buyers got together in the last week and broke recent records for volume of sales. Thursday, Friday, and Monday were the best days, with a considerable shrinkage in business yesterday and today, despite the fact that the metal is obtainable in several directions at 14c. delivered. Virtually all positions through February are included, with January delivery predominating. Export business is by no means active, yet it is not non-existent. For December copper 13.95c. f.a.s. was realized on several shipments. London has weakened in the last three days, and this has had a depressing effect on the domestic market.

### Lead Declines to 9 1/4c.

Though domestic buying of lead continues in satisfactory volume, and producers have very short supplies, the price has declined further, owing to continued weakness in London, American sellers being desirous of bringing the price down to a point where foreign bullion lead would not threaten the market. The decline in London has been continuous since last Friday, though today's quotation is only about half a pound less than a week ago. On Tuesday Dec. 8 the American Smelting & Refining Co. reduced its contract price from 9.50 to 9.25c., New York. The Smelting company's price has been generally obtained by other sellers throughout the week. Almost all the inquiries have been for December shipment and for small individual tonnages, the consumers apparently wishing to take care of only their immediate requirements, as is natural in a declining market. For shipment in February and later, the price has been more irregular, sales having been made both above and below the Smelting company's contract price. Based on today's London forward quotation, lead smelted from foreign ores could be sold economically in the domestic market for somewhat less than 9 1/4c. per lb.

In the Middle West, there has been little pressure to sell, and the principal producer has shown more restraint in reducing prices. When the New York price was 9 1/2c. he sold at 9.35c., and yesterday and today has been selling at 9.15c., compared to 9.25c. in New York. Other smaller sellers have been disposed to quote slightly lower prices, but have not done much business.

The situation seems to be getting somewhat better fundamentally as the price declines, and with any show of strength in London prices here would immediately respond. In fact, there would likely be some tendency for producers to lay in modest stocks should the price get down to 9c., as their reserve has been below normal for some time, with some smelters loading lead into the cars while it is still warm.

### Daily Prices of Metals

Dec.	Copper N. Y. net refinery*		Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N Y.	St. L.	St. L.	
3	13.75	61.75	62.75	9.50	9.325	8.55	
4	13.80	62.75	63.75	9.50	9.325	8.55@8.60	
5	13.825	62.75	63.75	9.50	9.325	8.70	
7	13.85	62.50	63.50	9.50	9.325	8.70	
8	13.75	62.50	63.50	9.30	9.15	8.725	
9	13.75	62.50	63.50	9.25	9.15	8.725	
Av.	13.788	62.458	63.458	9.425	9.267	8.663	

\*The prices correspond to the following quotations for copper delivered: Dec. 3, 14.00c.; Dec. 4, 14.05c.; Dec. 5, 14.075c.; Dec. 7, 14.10c.; Dec. 8 and 9, 14.00c.

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 Mining Journal-Press and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

### London

Dec.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
3	59 1/4	60 1/4	65 1/2	284 1/4	279 1/4	35 1/2	34 1/2	38 7/16	37 7/16
4	59 3/4	60 3/4	66	287 1/2	281 3/4	35 1/2	34 1/2	38 1/2	37 3/8
7	59 1/2	60 3/8	65 3/4	286 3/4	280 1/2	34 7/8	34 1/2	38 3/4	37 3/8
8	59 3/8	60 3/8	65 1/2	286 3/8	280 1/4	34 3/8	34 1/8	38 1/2	37 3/8
9	59 1/4	60 1/4	65 1/4	287 1/4	280 3/8	34 1/4	33 3/8	38 1/4	37 3/8

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

Dec.	Sterling Exchange "Checks"	Silver			Dec.	Sterling Exchange "Checks"	Silver		
		New York	London	Gold London			New York	London	Gold London
3	4.84 1/4	69 1/4	32 1/8	84s 11 1/2 d	7	4.84 1/8	69 1/4	32 1/8	84s 11 1/2 d
4	4.84 1/2	69 3/8	32 1/8	84s 11 1/2 d	8	4.84 3/8	69 1/4	32 1/8	84s 11 1/2 d
5	4.84 3/4	69 3/8	32 1/8		9	4.84 3/8	69 1/4	32 1/8	84s 11 1/2 d

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 three-eighths cent premium.



**Spot Zinc Is Scarce**

A wide spread in zinc prices is due to the scarcity of metal for spot shipment. Some is available, however, and sales have been made at prices ranging from 8.60c. to 8.80c. for December, the latter figure being realized yesterday. January metal is obtainable at 8.60c., February at 8.50c., and March at 8.40c., but business is decidedly limited for forward positions. The better grades are in demand, Brass Special being worth 9c. and High-Grade being held at 10½ to 10¾c., New York. Supplies of zinc are not believed to be large, not any great quantity of January metal being available.

**Tin Quiet and Steady**

Consumers have taken little interest in the tin market, though the price has held steady. London operators evidently think American demand must soon reassert itself and are willing to hold the bag till it does. Spot tin of either Straits or 99 per cent grade is virtually unobtainable. Three months' tin has sold for one-half to three-quarters of a cent less than near-by.

**Silver Steady**

Both the New York and London silver markets have been steady for the last week, with considerable local demand at prices below current levels. The unwillingness of sellers to part with their metal at concessions has maintained New York rates at above the London net parity during this period, and gives a firmer undertone for the future.

Mexican Dollars: Dec. 3d, 53¼c.; 4th and 5th, 53¾c.; 7th, 8th, and 9th, 53¾c.

**Foreign Exchanges Irregular**

The foreign exchange market has been irregular, with francs particularly weak. Closing cable quotations on Tuesday, Dec. 8, were: francs, 3.76c.; lire, 4.03c.; and German marks, 23.81c. Canadian dollars, par.

**Other Metals**

Quotations cover large wholesale lots unless otherwise specified.

**Aluminum**—99 per cent grade, 29c. per lb.; 98 per cent, 28c. London, 98 per cent, £118 per long ton.

**Antimony**—Per pound, f.o.b. New York: Chinese brands, spot, 19¼@20¼c. January, 19¼@19¾c. Cookson's "C" grade, spot, 21¾c. Oxide and needle antimony unchanged from Dec. 5.

**Bismuth**—\$3.25@3.30 per lb., in ton lots. London, 12s. 6d.

**Cadmium**—60c. per lb. London, 1s. 9d.

**Nickel**—Ingot, 34c.; shot, 35c.; electrolytic, 38c. (99.75 per cent); London, £170@£175 per long ton. Market firm; 2c. increase forecast for 1926.

**Osmium**—\$110 per oz.; London, £23 10s.@£25 10s.

**Platinum**—\$120 per oz. refined officially quoted. Sales also at \$115@118. Crude, \$114@114.75. London, £24 for refined; crude £22. Market has recently been good, but supplies are adequate.

**Quicksilver**—Per 75-lb. flask: \$90@91 for spot; forward, \$88@89. San Francisco \$90.33. London, £14½@£15. Good domestic demand, and Spanish production decreased.

The prices of Cobalt, Germanium Oxide, Iridium, Lithium, Magnesium, Molybdenum, Monel Metal, Palladium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Dec. 5.

**Metallic Ores**

**Manganese Ore**—Per long ton unit of Mn, c.i.f. North Atlantic ports: Brazilian, 42@44c., nominal; Indian, 44c., nominal; Caucasian (unwashed), 42c.; Caucasian (washed), 44c.

**Tungsten Ore**—Per unit of WO<sub>3</sub>, N.Y.: Wolframite, \$11.50@12.50; Western scheelite, \$12@12.75.

**Chrome Ore, Galena and Pyrite Radio Crystals, Iron Ore, Molybdenum, Tantalum, and Vanadium Ores** are unchanged from quotations in the Dec. 5 issue.

**Zinc Blende and Lead Ore Both Lower**

Joplin, Mo., Dec. 5, 1925

Zinc Blende	Per Ton
High	\$62.80
Premium, basis 60 per cent zinc	\$57.00@58.00
Prime Western, basis 60 per cent zinc	\$56.00
Fines and slimes, 60 per cent zinc	\$56.00@52.00
Average settling price, all	\$59.05

**Galena**

High	\$128.40
Basis 80 per cent lead	\$120.00
Average settling price, all	\$125.83

Shipments for the week: Blende, 16,164; calamine, 39; lead, 2,910 tons. Value, all ores the week, \$1,321,780.

Buying and selling transactions were closed tonight at 6 o'clock, with buyers obtaining only 10,000 tons on the lower offerings, of \$2 reduction on all grades of zinc.

Considerable lead was sold early in the week on \$125 basis, the price offerings declining today to \$120 per ton.

Sellers contend that buyers are merely reducing prices on account of the approaching tax-levy period of Dec. 31, in Oklahoma, and those outside the school districts, bearing the heavy taxation on concentrates, are slow to accept a lower offering.

Platteville, Wis., Dec. 5, 1925.

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	\$60.50
Lead Ore	
Lead, basis 80 per cent lead	\$122.00

Shipments for the week: Blende, 2,644 tons; lead, 100 tons. Shipments for the year: Blende, 45,123; lead, 2,251 tons. Shipments for the week to separating plants, 4,230 tons blende.

**Non-Metallic Minerals**

**Amblygonite, Andalusite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graph-**

**ite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon** are unchanged from prices in the Dec. 5 issue.

**Mineral Products**

**Arsenious Oxide (White arsenic)**—3¼c. per lb. Only an occasional carload sold. Some sellers asking 3¼c., but for a good tonnage, 3c. could probably be done. London, £15 per long ton.

**Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and Zinc Oxide** are unchanged from prices in the Dec. 5 issue.

**Ferro-Alloys**

**Ferrocerium, Ferrosilicon, Ferromanganese, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and Ferrovandium** are unchanged from the prices in the Dec. 5 issue.

**Metal Products**

**Rolled Copper**—Sheets, 22¼c.; wire, base price, 16c. per lb.

**Lead Sheets**—Full, 13¼c. per lb.; cut, 13¾c.

**Nickel Silver**—29¼c. per lb. for 18 per cent nickel Grade A sheets.

**Yellow (Muntz) Metal**—Dimension sheets, 20¾c. per lb.; rods, 17¾c.

**Zinc Sheets**—12c. per lb., f.o.b. works.

**Refractories**

**Chrome Brick, Firebrick, Magnesite Brick, Silica Brick, and Zirkite** are unchanged from prices in the Dec. 5 issue.

**Steel Firm—Pig Iron Dull—Coke Steady**

Pittsburgh, Dec. 8, 1925

The steel market in general presents fully as strong a tone as at any time in this movement, though there are decreases in activity in some lines, either from the season or, in the case of sheets, because there has been special activity on the eve of price advances. The whole sheet market has now worked up to the recently announced asking prices, making black sheets 3.35c.

Steel-mill operations continue at above the October rate, involving a production of more than 45,000,000 tons a year in ingots. Probabilities are strong that the year's ingot production will slightly exceed the record made in 1917, 43,619,200 tons.

**Pig Iron**—The market has grown still duller, but with prices easily maintained. Consumers are less concerned now that coke prices are within bounds. Bessemer, \$21, basic, \$20, foundry \$20.50, f.o.b. Valley furnaces.

**Connellsville Coke**—Standard furnace coke has been at about \$4 for nearly a fortnight, against slightly under \$3 last summer and about \$9 on its brief rise in October. Spot foundry is \$5@5.50.

## Reaction in German Metal Business

*Money Stringency Underlying Cause—Lead Exception  
to General Depression—Anaconda's Zinc  
Mine Transaction Protested*

By Dr. James Rubinfeld

Berlin, Germany

THE lofty expectations which were entertained last spring as to the likelihood of rapidly increasing metal consumption here have not thus far materialized. Although Germany still holds her own as the principal importer of American copper, and undoubtedly continues to influence the market for other metallic rawstuffs, numerous causes have occasioned a serious diminution on her part of participation in the world metal markets. The main factor is the credit and money stringency in Germany. Often even the best-known metal firms have to pay a minimum of 10 per cent when borrowing money with the banks. Other overhead charges are many times those of pre-war times so that steady draining consumes short or long-time American loans, with the result that bills are substituting in many cases the former paper money. But traders and importers do not want either of them, and general distrust is prevalent.

This is the background of the present disruption of affairs in Germany, which contributed to the decrease of copper, brass, nickel, and antimony imports in September as against October of the current year. The decrease in copper amounted to about 2,600 metric tons. A seeming exception to the rule is the case of lead and zinc, whereof a slight increase has been noted; but as far as sentiment goes here there is little doubt as to the weakness of the position of the latter, too.

Cable and brass manufacturers are complaining of receding orders, the former having been underbitten recently outside of the frontiers of this country in spite of their efficiency. The brass industry, which of itself is responsible for a consumption of about 100,000 metric tons of copper, is at present hard hit by the crisis in the German automobile trade that, in its turn, is being badly menaced by the influx of American, Italian, and even English or French cars. No longer than three months ago the German automobile trade appeared to be in a flourishing condition.

The engineering trades are suffering from the lack of orders from the Federal Railways which in normal periods form the "pièce de résistance" and the backbone of metal business. Then, in former months the Berlin agency of the Soviet government had purchased considerable quantities of half-manufactured copper, lead, zinc, and even tin and ferro-metals here by the aid of the so-called big credit which the German banks were able to grant to the Russians. Now, however, the Russian demands have been to some degree satisfied. One of the results of this state of things is that relatively heavy proportions of accumulated old metals, particularly old copper and brass and also lead scrap, which some time ago were eagerly bought abroad and brought in, now represent an additional capital burden to the holders.

As for zinc, it is profiting, of course, by the existing world inquiry for it, and German "remelted" has a pretty good outlet in Britain and elsewhere. The member firms of the German Zinc Smelters' Association have, however, recently adopted a cautious stand in view of the doubt that yet rules with regard to the agreement of W. A. Harriman, on behalf of Anaconda, with the heirs of Giesche, as far as the western Upper Silesian mines are concerned. The Prussian Government, which is afraid of the alienation of an uppermost key industry, has already intervened against the perfection of the contract. The usual argument for this intervention is that the plans of opening of mines and erection of zinc smelters and manufacturing plants in German Upper Silesia will be postponed by non-interested foreigners, who will be able to smelt German ores across the borders and sell the product as raw zinc or even sheets to German consumers. From the viewpoint of Germany, which has been bereft of adequate zinc supplies through the separation from her of rich mines and smelters, not only in Silesia but also in the now Belgian Moresnet district, the general feeling against the Giesche agreement may be understandable enough. It goes without saying that the conferences about the renewal of the an-

cient European Zinc Convention, which seem to be suggested by Belgian interests, possibly as a means of taking a stand against American predominance in the ore business, have been postponed until the pending matter of the Giesche lease will be cleared up; and also that the renewal of the Kattowitz Zinc Syndicate, as the above-named body is called here, is still in suspension.

Especially in the lead metal market, the futures markets, which for some time have existed in Berlin and Hamburg, may be regarded somewhat of a blessing in view of the particular hedging practices which hitherto had in every case rendered traders and jobbers here dependent upon the London Metal Exchange, anyhow.

Sales of aluminum, which had developed into good proportions here, are limited because not only across the Atlantic but in European countries the light metal is firmly monopolized by a few producers, who would be able to corner it and squeeze the jobbers at their will. The fear of some dumping by the subsidiaries of the Aluminum Company of America is somewhat of a bugbear in Europe, which has become more marked since the realization of the Canadian plans of the American giant. Great satisfaction has been felt here at the fact that in spite of excessive American duties, German aluminum could reach the longed-for American shores. It is hoped that this may only be a beginning. The German inland market for aluminum has contracted because of the plight of the automobile and kitchen utensils industries.

## Company Reports

### Ray Consolidated Earnings Climb

Earnings of the Ray Consolidated Copper Co., which operates the Ray mine, in Arizona, and the Chino mine, in New Mexico, during the third quarterly period of 1925 increased appreciably, according to the recently issued report. The total of \$1,002,265 compares with \$652,928 in the preceding quarter.

The net production of copper during the quarter is shown below in comparison with the output for the second and first quarters:

1925	Net Pounds Copper Produced	Average Monthly Production
First quarter.....	36,242,239	12,080,746
Second quarter.....	34,700,792	11,566,931
Third quarter.....	35,082,897	11,694,299

During the quarter a total of 1,554,800 tons of ore, averaging 1.42 per cent copper, was concentrated, against 1,454,400 tons, of an average copper content of 1.48 per cent, treated in the preceding quarter. This is equivalent to a daily average of 16,900 tons in the third quarter, compared with an average of 15,982 tons daily in the second quarter. The average mill recovery for the quarter was 81.88 per cent of the copper contained in the ore milled, corresponding to a recovery of 23.31 lb. of copper per ton of ore treated, compared with 82.42 per cent and 24.35 lb. in the preceding quarterly period.

The cost per pound of net copper produced from all sources, including charges for depreciation of plant and equipment and all fixed and general expenses and after crediting gold and silver and miscellaneous earnings, was 11.41c., compared with a cost, similarly computed, of 11.64c. per pound for the preceding quarter.

The financial outcome for the quarter, set out in comparison with the results for the second and first quarters of the year, is shown below:

	Third Quarter 1925	Second Quarter 1925	First Quarter 1925
Operating profit from copper production.....	\$1,167,730.27	\$815,155.71	\$1,127,034.58
Miscellaneous income, including value of precious metals.....	70,998.09	72,040.98	71,553.78
Total income.....	\$1,238,728.36	\$887,196.69	\$1,198,588.36
Depreciation.....	236,463.18	234,268.41	234,268.41
Increase in earned surplus....	\$1,002,265.18	\$652,928.28	\$964,119.95

The earnings for the third quarter are based on a carrying price of 14.24c. per pound of copper produced, compared with 13.50c. for the second quarter and 14.14c. for the first quarter.



### Shattuck Arizona Copper Co. Breaks Even for Quarter

The Shattuck Arizona Copper Co., which mines copper, lead, and silver at Bisbee, Ariz., earned \$1,838 during the quarter ended Sept. 30, 1925. The mill was operated continuously during the quarter. Experiments were made further to simplify the flow sheet and reduce power and water costs. However, it was found that savings in power and water were more than offset in recovery losses.

It is believed that a flow sheet has now been obtained that will give the best results, and that mill operations will be uniform in the future.

The exploration and development for the quarter totaled 2,210 ft. and the average cost was \$9.7693 per foot.

The production and costs for the quarter are as follows:

Class or Ore	Copper	Smelting Lead	Mill Lead	Siliceous
Dry tons mined.....	3,904.03	517.66	11,945.40	452.18
Dry tons treated.....	3,974.44	522.25	1,483.45(a)	184.83
Pounds copper recovered.	449,614.00	8,380.00	7,345.00	6,813.00
Pounds lead recovered....		27,874.00	870,991.00	
Ounces silver recovered...	8,491.00	9,235.00	38,907.00	2,520.00
Ounces gold recovered....	53.01	66.16	587.62	26.90
Net operating cost per pound.....	12.03c	3.64c (b)	10.07c	

(a) Concentrates. (b) Credit, account high silver.

The results in earnings for the quarter are as follows:

Income	
Refined copper at 14½c. per pound.....	\$65,194.03
Gold and silver (copper ores).....	6,285.10
Gross value direct lead.....	11,168.37
Gross value mill lead.....	115,006.18
Gross value silica.....	3,052.03
Interest.....	8,082.13
Dividends.....	510.00
	<b>\$209,297.84</b>
Expense	
Operating, copper.....	\$60,381.81
Operating, direct lead.....	7,972.65
Operating, mill lead.....	127,498.01
Operating, silica.....	1,757.03
Administrative and taxes.....	9,850.06
	<b>\$207,459.56</b>
Net income, before depletion and deferred development charges.....	<b>\$1,838.28</b>

### Utah-Apex Earned \$1,054,762 During Fiscal Year

Net earnings of the Utah-Apex Mining Co., producing lead, zinc, copper and silver in the Bingham district in Utah, were \$1,054,762 for the fiscal year ended Aug. 31, 1925, according to the report just issued. This is equivalent to \$1.99 a share on the 528,200 shares of stock, compared with loss of \$130,862 in the preceding fiscal year. Production during the two years compares as follows:

	1925	1924
Lead, lb.....	45,828,820	23,828,984
Zinc, lb.....	19,384,081	9,228,871
Copper, lb.....	3,989,981	1,187,605
Silver, oz.....	906,189	389,217

Current assets as of Aug. 31, 1925, were \$1,601,199, of which \$287,739 was cash and \$1,059,796 in Liberty bonds. Current liabilities amounted to \$178,908, leaving working capital of \$1,422,291.

The report states that exploration and development on various levels down to the 2,400 level has opened up valuable deposits of lead-silver-zinc and copper ores, which not only made possible the greatly increased and profitable production of the year, but are most encouraging as regards future operations. Geological conditions justify hopeful expectations for encountering ore below the 2,400 level.

The dispute with the Utah Delaware Mining Co. originated at a most inopportune moment. As a consequence of this dispute, mining in important orebodies has been suspended, thus reducing ore production and, consequently, profits. Among the orebodies in which mining has been impeded by it is an important copper deposit on the 2,400 level, proceeds from which would have appreciably increased receipts.

The controversy continues in *status quo* of conferences between representatives of the two companies in the East, and exploration on the ground by the Utah Delaware in quest of evidence in support of their attitude.

Utah-Apex shaft is now being sunk to the 2,400 level as a four- instead of three-compartment shaft.

### Ahumada Earned \$1,260,232 in Nine Months of 1925

The Ahumada Lead Co., operating in northern Chihuahua Mexico, reports for nine months ended Sept. 30, net income of \$1,260,232 after charges, equivalent to \$1.05 a share on the outstanding \$1 par value stock. Net income for the third quarter is equal to 41c. a share compared with 28c, a share in the preceding quarter and 35c. a share in the first quarter. The company produced in the first nine months 60,373 tons of ore, from which was obtained 25,549,148 lb. of refined lead, an average of 423.2 lb. per ton. Sales totaled 24,045,807 lb. of lead.

### Colombian Corporation Continues Development

The annual report of The Colombian Corporation, Ltd., for the year ended Dec. 31, 1924, has just been issued. This company owns, through the Oroville Dredging Co., Ltd., the Constancia gold and silver mine, in Colombia. The assets and liabilities are as follows:

	Assets	
	Dec. 31, 1924	Sept. 30, 1925
Cash in bank and on hand.....	£2,688	£2,365
Concentrates.....	3,335	3,335
Debtors.....	3,718	413
Calls in arrears.....	1,641	1,360
	<b>£11,382</b>	<b>£7,473</b>
Liabilities		
Nechi Mines, Ltd.....	£87,144	£89,278
Oroville Dredging Co., Ltd.....	38,460	69,442
Sundry creditors, including bank overdraft in New York.....	11,872	
	<b>137,476</b>	<b>170,262</b>
Debit balance.....	£126,095	£170,262

Mine developments for the year indicated an additional 79,640 tons of fully and partly developed ore below the third level, in addition to that estimated by J. D. Hoffman in 1923. The total tonnage below the third level is now estimated at 123,916 tons, of an average of 5.17 dwt. (0.258 oz.) per ton. Plant construction was completed in April, 1925, and from that date the mill has been operating continuously. For the period ended Aug. 31, 1925, 24,640 tons was milled, yielding \$84,633, averaging \$3.44 per ton, the operating costs amounting to \$92,416, averaging \$3.75 per ton.

At the annual meeting of the company held in London on Nov. 5, Mr. Baker spoke of the disappointing milling results, but indicated that some higher-grade ore was in prospect and that with the mill operating at nearer capacity profitable operations should ensue. A scarcity of labor in Colombia has hindered work, 100 additional underground men being required. The poor recovery in the mill—only 65 per cent of the gold—is being investigated, and it may be that finer grinding will be resorted to. Finally, Mr. Baker said that the situation was more encouraging than at this time last year, but that the future prosperity of the company depends upon finding more and higher-grade ore, particularly below the fifth level.

### Rate of Zinc Production Practically Unchanged in October

Data compiled by the American Bureau of Metal Statistics show the rate of zinc production in the world to have been practically unchanged in October, compared with September, though the total is somewhat greater owing to the longer month.

#### Tons Slab Zinc Produced

	Sept., 1925	Oct., 1925	Jan.-Oct., 1924	Jan.-Oct., 1925
United States.....	47,384	50,497	445,502	486,505
Canada.....	4,024	3,902	23,248	30,117
Mexico.....	135	320		556
Belgium.....	15,624	16,457	147,905	156,178
Germany.....	5,100	5,200	94,899	54,200
Polish Silesia.....	8,800	9,300		88,775
Australia.....	4,267	4,409	43,501	42,605
Great Britain.....	3,752	3,450	35,023	38,964
Others estimated.....	13,300	13,500	118,000	133,600
Totals.....	<b>102,400</b>	<b>107,000</b>	<b>908,100</b>	<b>1,031,500</b>

World stocks of slab zinc on Nov. 1, 1925, are estimated by A. J. M. Sharpe to be 28,198 tons, compared with 24,693 on Oct. 1.

# Mining Stocks—Week Ended December 2, 1925

Stock	Exch.	High	Low	Last	Last Div.	Stock	Exch.	High	Low	Last	Last Div.		
<b>COPPER</b>						<b>SILVER</b>							
Anaconda	New York	49 1/2	48 1/2	49 1/2	Oct. 17, No. 23, Q	0.75	Alvarado	N. Y. Curb	*75	*75	*75	Oct., 1920	0.50
Arcadian Consol.	Boston	*90	*75	*75			Beaver Consol.	Toronto	*51 1/2	*47 1/2	*50 1/2	May, 1920	0.03
Ariz. Com'l.	Boston	13	12 1/2	12 1/2	Jy. 2, Jy. 31 SAO	0.50	Castle-Trethewey	Toronto	1.49	1.40	1.46		
Calaveras	N. Y. Curb	4	4	4			Coniagas	Toronto	4.50	3.50	4.30	May, 1924	0.12
Calumet & Hecla	New York	58 1/2	56	56	De. 4, De. 21 QX1	0.50	Keeley	Toronto	1.51	1.43	1.50	Au. 31, Se. 15 X	0.12
Cerro de Pasco	New York	63	60	60 1/2	De. 10, De. 22, X 1	0.60	Kerr Lake	N. Y. Curb	1 1/2	1 1/2	1 1/2	Oct. 1, Oct. 15 Q	0.12
Chile Copper	New York	35 1/2	34	34 1/2	De. 2, Dec. 28, Q 62	0.20	La Rose	Toronto	*38	*36	*37	Apr., 1922	0.10
Chino	New York	20 1/2	20 1/2	20 1/2	Sept., 1920	0.37 1/2	Lorrain Trout Lake	Toronto	*90	*80	*80	Jy. 2, Jy. 15	0.05
Con. Coppermines	N. Y. Curb	2	1 1/2	2			McKinley-Dar-Sav	Toronto	*23	*19	*22 1/2	Oct., 1920	0.03
Copper Range	Boston	20	19 1/2	19 1/2	May, 1925	1.00	Mining Corp. Can.	Toronto	3.14	3.04	3.10	Jy. 1, Jy. 15	0.12
Crystal Copper	Boston	*53	*49	*51			Nipissing	N. Y. Curb	6 1/2	5 1/2	6 1/2	Se. 30, Oct. 20, Q	0.15
East Butte	Boston	3 1/2	3 1/2	3 1/2	Dec., 1919	0.50	Tomiskaming	Toronto	*13	*12	*12	Jan., 1920	0.40
First National	Boston	*20	*18	*18	Feb., 1919	0.15	<b>SILVER-LEAD</b>						
Franklin	Boston	1 1/2	1	1			Ahumada	New York	9 1/2	9	9 1/2	De. 15, Ja. 2, X	0.25
Granby Consol.	New York	20 1/2	18 1/2	20 1/2	May, 1919	1.25	Bingham Mines	Boston	55	53	54	De. 19, De. 20 Q	1.00
Greene-Canaan	New York	13 1/2	13	13 1/2	Nov., 1920	0.50	Cardiff M. & M.	Salt Lake			*63	De. 16, No. 18	0.10
Hancock	Boston	*50	*50	*50			Chief Consol.	Salt Lake	3.95	3.85	3.90	Oct. 10, No. 1	0.10
Howe Sound, new, r.t.c.	New York	28	24 1/2	27 1/2	Oct. 5, Oct. 15 Q	0.50	Columbus Rexall	Salt Lake			1.25	Aug., 1923	0.05
Inspiration Consol.	New York	27	26 1/2	26 1/2	De. 17, Ja. 4, QO	0.50	Eruption	Boston Curb	2 1/2	1 1/2	2 1/2	De. 15, Ja. 2, X	0.10
Iron Cap	Boston	2 1/2	2 1/2	2 1/2	May, 1923	0.15	Federal M. & S.	New York	78 1/2	71 1/2	77	No. 25, De. 15 Q	1.75
Isle Royale	Boston	12 1/2	12	12	Nov. 30, De. 5	1.00	Federal M. & S., pfd.	New York	93 1/2	85 1/2	92 1/2	Au. 25, Se. 15	1.75
Jerome Verde Dev.	N. Y. Curb	1 1/2	*70	*95			Hecla Mining	N. Y. Curb	18	17 1/2	18	No. 15, De. 15 Q	2.00
Kennebec	Boston	56 1/2	54 1/2	55	De. 4, Jan. 2 Q	1.00	Iron Blossom Con.	Salt Lake			*39	Oct. 25, 1924	0.01
Lake Copper	Boston	1 1/2	1	1 1/2	June, 1925	0.50	Iron King Mining	Salt Lake	*43	*40	*43		
Magma Copper	New York	44	43 1/2	43 1/2	Oct. 1, Oct. 15, Q	0.75	Keystone Mining	Salt Lake	*65	*62	*63	Au. 12, Au. 26	0.07 1/2
Mason Valley	N. Y. Curb						Lucky Jim	Spokane	*12 1/2	*12 1/2	*12 1/2		
Mass Consolidated	Boston	*50	*50	*50	Nov., 1917	1.00	Mammoth Mining	Salt Lake	3.05	2.92	3.05	May, 1925	0.10
Miami Copper	New York	12	10 1/2	11 1/2	No. 2, No. 16 Q	0.25	Marsh Mines	Spokane	*7 1/2	*7	*7	Se. 15, Oct. 1	0.15
Mohawk	Boston	33	32 1/2	33	Oct. 31, De. 2	1.00	Ontario Silver	New York			10 1/2	Jan., 1919	0.50
Mother Lode Co.	New York	7 1/2	7 1/2	7 1/2	De. 11, De. 31	0.37 1/2	Park Utah	Salt Lake	7.95	7.05	7.60	Se. 15, Oct. 1	0.15
Nevada Consol.	New York	13 1/2	13 1/2	13 1/2	Sept., 1920	0.25	Prince Consol.	Salt Lake	*10	*9 1/2	*10		
New Cornelia	Boston	19 1/2	19 1/2	19 1/2	Oct. 6, No. 23 Q	0.25	Silver King Coal	Salt Lake	10.37 1/2	9.50	10.37 1/2	De. 15, Ja. 2, QX	0.35
North Butte	Boston	3 1/2	3 1/2	3 1/2	Oct., 1918	0.25	Silversmith	Spokane	*34	*33	*33 1/2	Oct. 1, Oct. 10	0.01
Ohio Copper	N. Y. Curb	*80	*75	*75	Nov. 14, De. 2	0.05	Tamarack-Custer	Spokane	*37	*33	*36	Sept., 1924	0.25
Old Dominion	Boston	18 1/2	17 1/2	18	Dec., 1918	1.00	Tintie Standard	Salt Lake	14.25	13.50	14.25	Se. 22, Se. 29	0.40
Phelps Dodge	Open Mar.	128	125	122	Se. 19, Oct. 2 Q	1.00	Utah-Apex	Boston	7	6 1/2	6 1/2	Oct. 3, Oct. 15, Q	0.35
Quincy	Boston	23 1/2	22	22	Mar., 1920	1.00	Western Utah Copper	N. Y. Curb			*10		
Ray Consolidated	New York	12 1/2	12 1/2	12 1/2	Dec., 1920	0.25	<b>IRON</b>						
Ray Hercules	N. Y. Curb			14			Bethlehem Steel	New York	49 1/2	47	48 1/2	July, 1924	1.25
St. Mary's Min. Id.	Boston	36	35 1/2	35 1/2	May, 1925	3.00	Colorado Fuel & Iron	New York	38	34 1/2	37 1/2	May, 1921	0.75
Seneca Copper	Boston	9 1/2	9 1/2	9 1/2			Gt. North'n Iron Ore	New York	27 1/2	25	25 1/2	De. 4, De. 28	0.75
Shannon	Boston	*70	*55	*60	Nov., 1917	0.25	Inland Steel	New York	44 1/2	43	44	No. 13, De. 1 Q	0.62 1/2
Shattuck Arizona	New York	6 1/2	6 1/2	6 1/2	Jan., 1920	0.25	Meabi Iron	N. Y. Curb	2	1 1/2	1 1/2		
Superior & Boston	Boston	1 1/2	1	1			Replogle Steel	New York	16 1/2	15	15 1/2		
Tenn. C. & C.	New York	15 1/2	13	15 1/2	De. 31, Ja. 15, Q	0.25	Republic I. & S.	New York	59 1/2	56 1/2	58	May, 1921	1.50
United Verde Ex	N. Y. Curb	27	26	27	Oct. 6, Nov. 20	0.75	Republic I. & S., pfd.	New York	94	92 1/2	94	De. 15, Ja. 2, Q	1.50
Utah Copper	New York	111	111	111	Se. 18, Se. 30, Q	1.00	Sloss-Sheffield S. & I.	New York	141	131 1/2	140 1/2	De. 10, De. 21 Q	1.75
Utah Metal & T	Boston	*75	*60	*74	Dec., 1917	0.30	Sloss-Shef. S. & I., pfd.	New York	101 1/2	101 1/2	101 1/2	De. 21, Ja. 2, Q	1.75
Victoria	Boston	*41	*30	*35			U. S. Steel	New York	135 1/2	128 1/2	134 1/2	No. 28, De. 30 QX	1.75
Walker Mining	Salt Lake	1.70	1.65	1.65			U. S. Steel pfd.	New York	125 1/2	125 1/2	125 1/2	No. 3, No. 28, Q	1.75
							Virginia I. C. & C.	New York	45	43	45	Jan., 1924	1.50
							Virginia I. C. & C., pfd.	New York			77	De. 15, Ja. 2,	2.50
<b>NICKEL-COPPER</b>						<b>VANADIUM</b>							
Internat. Nickel	New York	48 1/2	44 1/2	47 1/2	Se. 11, Se. 30, Q	0.50	Vanadium Corp.	New York	32 1/2	30 1/2	32	No. 2, No. 16 Q	0.50
Internat. Nickel, pfd.	New York			100 1/2	Oct. 15, No. 2, Q	1.50	<b>ASBESTOS</b>						
<b>LEAD</b>						<b>SULPHUR</b>							
Gladstone M. M. Co.	Spokane	*29	*26	*28 1/2	No. 1, No. 10 M	0.0 1/2	Asbestos Corp.	Montreal	95	93	93 1/2	Se. 30, Oct. 15 Q	1.50
National Lead	New York	166	162 1/2	164	De. 11, De. 31 Q	2.00	Asbestos Corp., pfd.	Montreal	115	114	114 1/2	Se. 30, Oct. 15, Q	1.50
National Lead pfd.	New York	116 1/2	116 1/2	116 1/2	Aug. 21, Se. 15	1.75	<b>DIAMONDS</b>						
St. Joseph Lead	New York	46 1/2	44 1/2	46 1/2	Nov. 10, De. 21 Q	1.05	De Beers Consol.	New York			27 1/2	Jy. 27, Au. 30	0.97
<b>ZINC</b>						<b>PLATINUM</b>							
Am. Z. L. & S.	New York	11	9 1/2	10 1/2	May., 1920	1.00	So. Am. Gold & P.	N. Y. Curb	6	5 1/2	6		
Am. Z. L. & S., pfd.	New York	44 1/2	37	43 1/2	Nov., 1920	1.50	<b>MINING, SMELTING, REFINING AND GENERAL</b>						
Butte C. & Z.	New York	6 1/2	6 1/2	6 1/2	De. 10, De. 24	0.50	Amer. Metal	New York	53 1/2	52 1/2	53 1/2	No. 20, De. 1, Q	1.00
Butte & Superior	New York	15 1/2	13 1/2	15 1/2	De. 9, De. 24	0.50	Amer. Metal pfd.	New York	118 1/2	118	118 1/2	No. 21, De. 1, Q	1.75
Callahan Zn-Id.	New York	2 1/2	2 1/2	2 1/2	Dec., 1920	0.50	Amer. Sm. & Ref.	New York	123 1/2	119 1/2	123 1/2	Oct. 16, No. 2, Q	1.75
New Jersey Zn.	N. Y. Curb			214 1/2	No. 20, Dec. 10 X	2.00	Amer. Sm. & Ref., pfd.	New York	113	112 1/2	112 1/2	No. 6, De. 1, Q	1.75
United Zinc	N. Y. Curb			*35			Consol. M. & S.	N. Y. Curb	154	152	152	Jan. 30, Jy. 15	0.75
Yellow Pine	Los Angeles	*50	*45	*45	Se. 10, Se. 21 Q	0.04	Federated Metals	N. Y. Curb	25	24 1/2	24 1/2		
<b>GOLD</b>						<b>MINING, SMELTING, REFINING AND GENERAL</b>							
Alaska Juneau	New York	2	1 1/2	2			Newmont Mining	N. Y. Curb	45 1/2	45 1/2	45 1/2	Oct. 1, Oct. 15	0.60
Argonaut	Toronto	*16 1/2	*15	*16			Southwest Metals	N. Y. Curb			2 1/2		
Barry-Hollinger	Toronto	*26	*25	*25 1/2			U. S. Sm. R. & M.	New York	46 1/2	45 1/2	46	Oct. 7, Oct. 15, Q	0.75
Carson Hill	Boston			*30			U. S. Sm. R. & M., pfd.	New York	42	47 1/2	48	Oct. 7, Oct. 15, Q	0.87 1/2
Consol. W. Dome L.	Toronto	*16 1/2	*16	*16 1/2			* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.						
Cresson Consol. G.	N. Y. Curb	2 1/2	2 1/2	2 1/2	Se. 30, Oct. 10	0.10	Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange and George H. Watson & Co.; Colorado Springs, Colorado Springs Stock Exchange.						
Crown Reserve	Toronto	*17 1/2	*16	*16 1/2	Jan., 1917	0.05	<b>LONDON QUOTATIONS, WEEK ENDED NOV. 28, 1925</b>						
Dome Mines	New York	17 1/2	17 1/2	17 1/2	De. 31, Ja. 20, Q	0.50	Aramayo Mines (25 fra.)	High	Low	Last	Date	Per Cent	
Golden Cycle	Colo. Springs	1.51	1.51	1.51	No. 30, Dec. 10 Q	0.03	British Platinum	7/6	6/6	7/6	Nov. 1925	5(c)	
Hollinger Consol.	Toronto	16.90	16.75	16.85	Nov. 19, Dec. 2	0.08	Burma Corp. (10 rupees)	19/3	18/3	18/6	Feb. 1925	2 1/2	
Homestake Mining	New York	48	47	47 1/2	De. 19, De. 26 M	0.50	Bwana M'Kubwa	7/-	6/6	7/-	Aug. 1925	6 annas.	
Kirkland Lake	Toronto	*76	*69 1/2	*74			Camp Bird	6/-	5/-	5/6			
Lake Shore	Toronto	9.80	9.55	9.75	De. 1, De. 15 XQO	1.10	El Oro	5/10 1/2	5/6	5/9	Nov. 1924	2 1/2*	
McIntyre-Porcupine	New York	22	21 1/2	22	No. 2, De. 1 Q	0.25	Esperanza	1/-	-/9	1/-			
Newray	Toronto	*43	*35	*40			Frontino & Bolivia	9/9	8/9	9/6	July 1925	3 1/2	
Night Hawk Pen.	Toronto	*8 1/2	*6	*8			Mexican Corporation	21/6	19/4 1/2	21/-			
Portland	Colo. Springs			*43			Mexican Mines of El Oro	37/6	36/3	36/3	Dec. 1925	12 1/2*	
Rand Mines	New York			33 1/2			Neechi (prof. lbs.)	1/3	1/-	1/-	1921-22	25	
Teck-Hughes	Toronto	2.49	2.23	2.48			Oroville Dredging						