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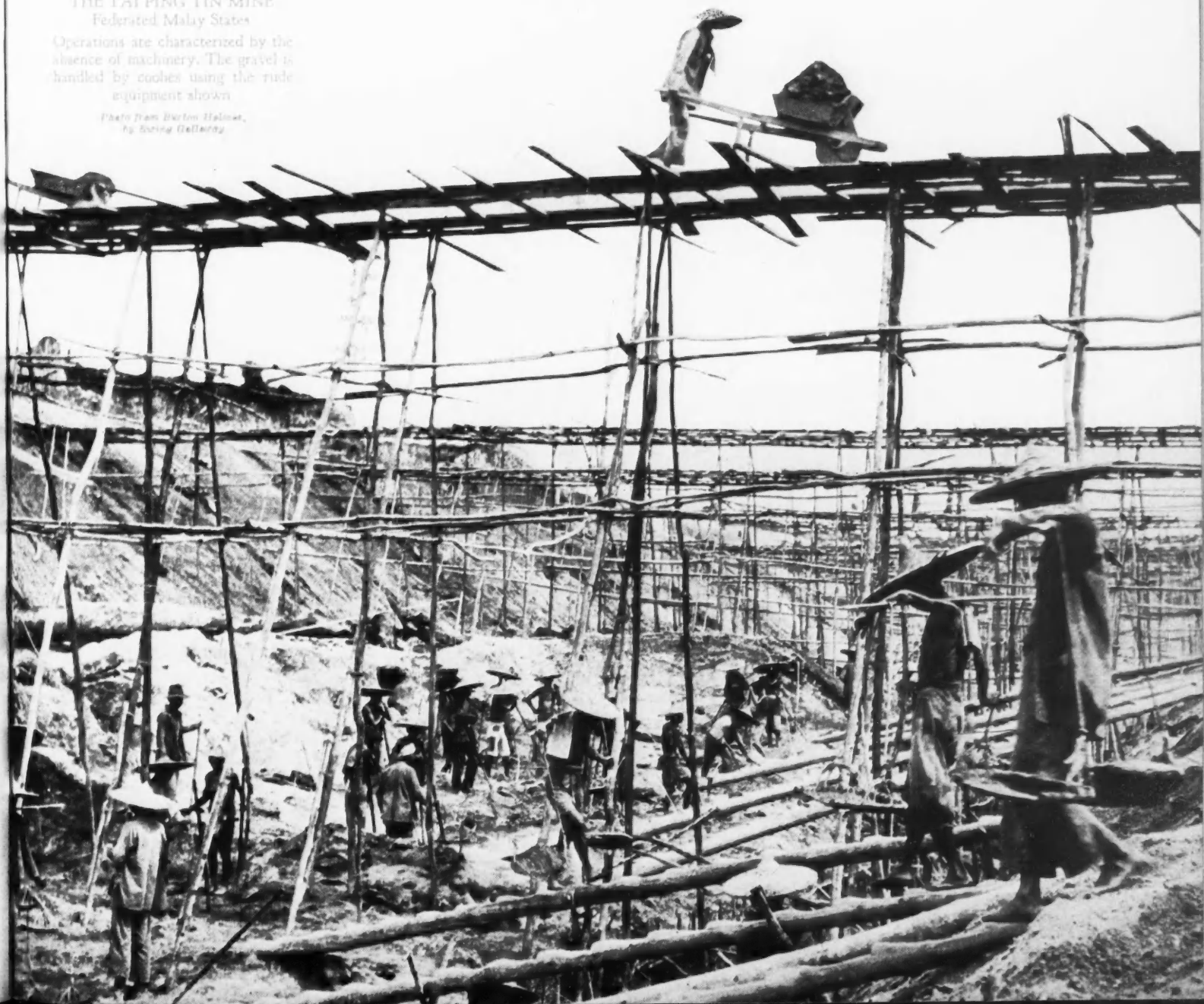
Mexico: A Field for Investment, by J. C. Pickering— Evolution of
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THE TAI PING TIN MINE

Federated Malay States

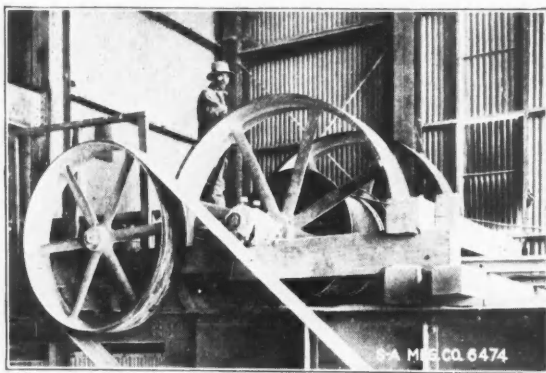
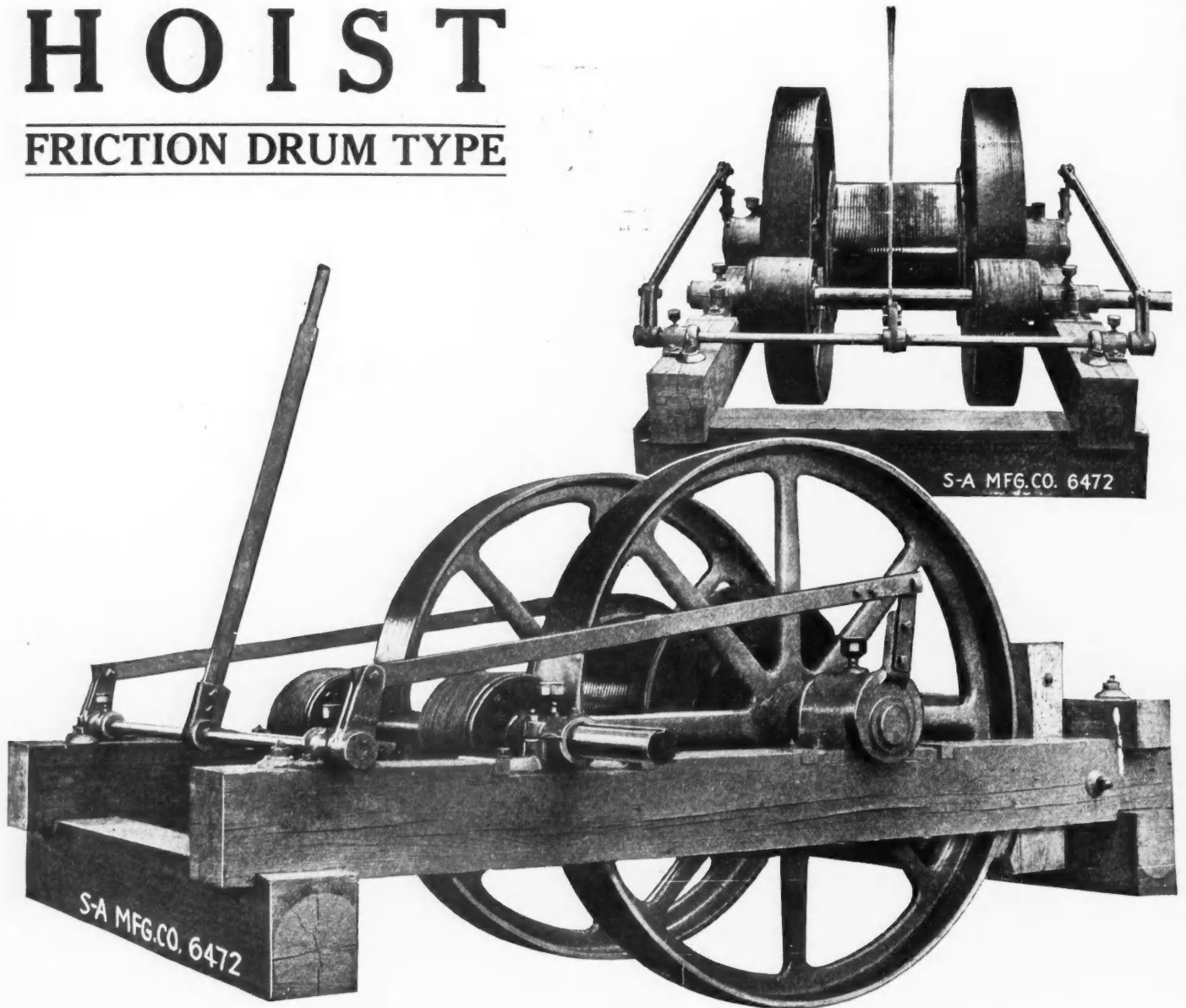
Operations are characterized by the
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handled by coolies using the rude
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ENGINEERING AND MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 120

New York, December 5, 1925

Number 23

A Record Petroleum Output

ACCORDING to W. C. Teagle, of the Standard Oil Co., the 164,000,000 bbl. of crude oil burned as fuel in the United States in 1924 represented overproduction, inasmuch as coal could have been used just as well instead. His statement is interesting in view of the fact that almost as soon as the subject of conservation of petroleum and Federal control began to be agitated, toward the end of 1924, various spokesmen for producing interests suddenly found that there was no such factor as overproduction in the existing situation. Some color was lent to the statement by the fact that imports and withdrawals from stocks were necessary to meet the current consumptive demand. Thus, in the first eight months of 1925 it was necessary to import over 57,000,000 bbl. to help meet the demand of 602,000,000 bbl., of which 74,000,000 was for export trade and the balance for use at home. At first glance it would appear nonsensical to speak of overproduction in the face of figures such as these. But the long-continued weakness of the market, both for crude and refined oils, is ample evidence that far too much oil is being produced.

Last year for the first time in six years production of petroleum in the United States declined from that of the year before. That is, the output of 732,407,000 bbl. in 1923 was succeeded by a production of 713,940,000 bbl. in 1924, a drop of about 2.5 per cent. The decrease was hailed with relief, and even those who said that no such thing as overproduction existed, seemed glad to see the output less. But their relief was of short duration. Scarcely had the present year well started on its course when the Smackover field, in Arkansas, began to yield new and increased production from a certain deeper sand. As a result, Arkansas, instead of producing about 45,000,000 bbl. in 1925, will have produced by the end of December, it is estimated, about 80,000,000 bbl. of petroleum. As a further result, the rest of the country's output having varied but little from last year's, the total production of crude in the United States will be, in 1925, about 763,500,000 bbl., a new high record and an increase of about 7 per cent over the output of 1924.

The optimists referred to recovered their poise, which had been disturbed by the Smackover performance, as soon as they noted that the new production from Smackover was chiefly of a heavy crude, more suitable for burning as fuel oil and less adapted for cracking purposes than lighter oils would be. But practically any oil can be cracked if market conditions warrant, and the optimism referred to failed to have any effect on the market.

To the layman, who is apt to think of the petroleum industry in terms of gushers, the fact of overproduction will be not at all surprising. That to him seems perfectly natural. But gushers are few and oil wells are many and the production per well is exceedingly

small. Someone has figured that Oklahoma, with about 60,000 producing wells, is getting about 8 bbl. as a daily average, Texas' 20,000 producing wells are yielding about 18 bbl. daily per well, and California's 12,000 about 52 bbl. daily. Figures such as these, together with statistics showing the decline of particular pools, reveal very clearly how rapidly the petroleum resources of the United States are being depleted. It is true that 80 per cent of the oil still remains in the ground after pumping has ceased to recover and that a small part of this may be brought to surface by forced recovery methods. Mining for oil has also been tried and no doubt has limited possibilities. Oil shale, too, holds out its promise of future production. But these things lie in the more or less uncertain future, and in the meantime a present abundant resource is being rapidly depleted.

Relative Prosperity of Workingmen

REAL WAGES are wages measured in terms of what the worker can buy with his earnings; and the National Industrial Conference Board of New York has found that there is a gratifying tendency toward the increase of real wages, not only in the United States but in Europe. This has been made possible largely through more efficient methods of production, whether mechanical or otherwise. The steel and the automobile industries are illustrative of this, for wages have risen in far greater proportion than prices of product. In the automobile industry, indeed, wages have risen while prices for automobiles have declined. The result is that in "real" earnings the American workman today is 24 per cent better off than at the beginning of the war in 1914, and 5 per cent better off than at the peak of wages in 1921.

During the first half of the current year, there has been a gaining of European "real" wages, over the American "real" wages, which has remained practically stable during that period. Canadian and Australian wages have participated in the same general improvement.

The relative welfare of workers in the different world centers is of such great interest that we copy below the full table:

City	1925	
	June	January
Philadelphia, U. S. A.	100	100
Ottawa, Canada	81	69
Sydney, Australia	77	70
London, England	55	45
Copenhagen, Denmark	53	41
Amsterdam, Holland	46	37
Oslo (Christiania) Norway	45	38
Stockholm, Sweden	40	36
Berlin, Germany	34	29
Lodz, Poland	33	27
Brussels, Belgium	32	28
Prague, Czechoslovakia	28	29
Warsaw, Poland	28	23
Rome, Italy	27	23
Milan, Italy	27	21
Vienna, Austria	26	23

These calculations, it must be added, are based upon what wages will purchase in food and shelter alone.

Business Conditions Good

BUSINESS IS EXCELLENT, and a spirit of optimism is spreading, says the National Bank of Commerce in its monthly discussion of market conditions. Production of iron and steel is increasing, it continues, other industries are showing less than a normal seasonal decline, and the next few months may see a marked expansion of operations in those lines of business which until now have shared least in the upward movement that has been under way since mid-summer of 1924.

How are conditions in the mining industries? In the non-ferrous field, the principal producers of metals with the exception of gold find themselves in a fairly comfortable position. With copper around 14½c., lead around 9½c. and zinc in the neighborhood of 8½c., to say nothing of silver at 70c., they surely have nothing of which to complain, so far as price is concerned, though like *Oliver Twist* they naturally are desirous of more. Exceptions there are, of course, as in the Michigan copper country. From practically all districts is reported an adequate supply of labor. Producers of gold are still in the same position in which increased costs in the face of an unchanging price for gold have placed them: improvement of their condition must come wholly from within, by economies and bettering of their processes.

Outside of the non-ferrous field are the important iron-mining and petroleum industries. As in the bituminous field there are too many mines for conditions to be basically sound, so in the Lake Superior iron country, from which comes the bulk of the domestic iron ore produced, the active productive capacity of existing mines exceeds the estimated average annual consumptive demand for the next five years by some 30,000,000 tons, according to L. P. Barrett of the Michigan Tax Commission. As a natural result, the iron-ore market is weak; and the condition is aggravated by the heavy taxation imposed on the operators by the local communities. The season just closed has shown improvement over the last, nevertheless, though far from being good. As with iron ore and bituminous coal, so it is in the petroleum industry, the conditions of overproduction in which are discussed on the preceding page.

Thus, on the one hand, producers of lead, zinc, silver, and copper are enjoying conditions leading to fair prosperity. On the other are the producers of gold, iron ore, and petroleum, who from different causes are not getting an adequate price for their products. However, they are running and not shut down, so conditions might easily be worse. Taking it by and large, therefore, the mining industries of the United States have reason to be thankful.

Mineral Resources the Basis of Industrial Prosperity

PRESIDENT COOLIDGE, in his recent address before the Chamber of Commerce in New York City, dwelt at length upon the resources of this country and their utilization in stabilizing political and industrial conditions in Europe. He said:

"By wise policies, pursued with tremendous economic effort, our country has reached its present prosperous condition. The people have been willing to work because they have had something to work for. The per capita production

has greatly increased. Out of our surplus savings we have been able to advance great sums for refinancing the Old World and developing the New.

"I should regret very much to see our possession of resources which are available to meet needs in other countries be the cause of any sentiment of envy or unfriendliness toward us. It ought everywhere to be welcomed with rejoicing and considered as a part of the good fortune of the entire world that such an economic reservoir exists here which can be made available in case of need.

"Every one knows that it was our resources that saved Europe from a complete collapse immediately following the armistice. Without the benefit of our credit an appalling famine would have prevailed over great areas."

The resources to which the President referred were largely cash and credit, which are recognized by bankers as a basis for conducting business. But what is back of this cash (savings) and credit upon which banks rely?

Of the basic natural resources which meet the demands of an industrial and commercial world, the United States has enormous supplies and today is the largest producer of many of these. As, for example, of the world's copper production the United States supplies 54 per cent; petroleum, 70; pig iron, 50; zinc, 46; lead, 39; coal, 38; silver, 23, and gold, 13. In addition to this, agriculture, livestock and lumber add their quota to establish a business credit.

Though this country is a large producer in many natural-resource industries, and especially in mining, it does not necessarily follow that it exports its major production of all, or even any one, of them. In the wise and proper utilization of the country's resources lies the strength of the industries dependent upon them. It is upon these that great domestic manufacturing industries have been built, which in turn export their products to foreign countries. Savings from domestic enterprises are the basis of cash and credit to which the President referred.

The value of the annual mineral production of the United States is approximately \$5,000,000,000. Without this, our industrial and commercial status as a nation would be on a par with the Indian in 1492; our banking institutions would be lacking; the development of latent agricultural possibilities would not be in even the embryo state. The nations that progress are those that utilize their mineral resources to the fullest extent, or are in such a position that they can exchange agricultural or factory products for raw minerals or metals. The American Indian, satisfied with wild fruit, herbs, and game, for centuries hunted over the iron ranges of Minnesota, the oil fields of California and Oklahoma, the coal fields of the Appalachian region, and the copper deposits of Michigan, Montana, and Arizona. The nomads of central Asia travel over deposits of iron, coal, and copper in quest of sustenance from the organic kingdom. These nomadic people made but little progress and contributed nothing to the world civilization, while great advance has been made by those nations which wisely develop and use their mineral resources.

Aluminum From Clay

IN GERMANY, it is said, the question of whether aluminum will supplant copper is receiving more attention than ever, because of the opening of hydroelectric developments that will make cheaper power possible. Cheap power, let it be understood, is one of the requisites in the manufacture of aluminum. At present

the capacity of German plants is estimated at 36,000 tons a year and the production at 24,000 tons. World production is placed at 162,000 tons, so the relative position of Germany can readily be seen. Production of the metal has increased very rapidly there since before the war, when, in 1913, the output, it is said, was less than 1,000 tons. The substitution of aluminum for copper for electrical uses has already made considerable inroads in the market of the copper producers, and wider use of the lighter metal will tend still further to lessen the demand for copper.

Aluminum is used in the form of bare cables, for overhead electrical transmission, as busbars, and in the field coils of heavy traction motors. It has been used for insulated work to a limited extent. One pound of aluminum will do the work of two pounds of copper, for electrical purposes, so there is a saving in the cost of the metal alone at any price which is less than double that of copper. Even when the price of aluminum is more than double that of copper, there is an advantage in using it in building high-tension power lines, because when reinforced, it can be more tightly strung than copper, this permitting the towers to be spaced more widely, necessitating fewer of them. Whether aluminum displaces copper, however, is largely a matter of relative cost, and the Germans will find it necessary to lower their production cost if they are to attain the desired end.

There are clays more plentiful than bauxite, which, if they could be made to yield aluminum on a commercial basis, would undoubtedly give a cheaper metal. The *Financial Times*, of London, states that Germany is "on the eve of the adoption of an entirely new chemical process for isolating aluminum from clay that will make the import of bauxite unnecessary." If true, this is important. Eventually there is little doubt that a way will be found to extract the aluminum from clay. If the Germans have discovered it, another technical achievement must be recorded to their credit. R. J. Anderson, in his new book on "Metallurgy of Aluminum and Aluminum Alloys," says that what is needed to make high-grade kaolin available as an aluminum ore is "a cheap method of separating the alumina from the silica." "If this could be worked out," he continues, "no other aluminum mineral could compete with kaolin as a source of aluminum. . . . Much experimental work has been done (with kaolin and other clays) but unfortunately all efforts made to date have been commercial failures. Many of them have also been technical failures."

Further news from Germany regarding these developments will be awaited with considerable interest. Or will the Germans imitate the Aluminum Company of America and keep the matter secret?

Paying for Government Publications

SINCE THE PUBLICATION of the annual volumes of "Mineral Resources of the United States" has been taken over by the U. S. Bureau of Mines, which bureau has been absorbed by the Department of Commerce, a price has been placed upon the various separate chapters of this valuable work. Formerly, the Geological Survey distributed these pamphlets gratuitously, but now, apparently, the free supply has been considerably curtailed, and those who desire copies are

invited to send a nominal sum, usually 5c., to the Superintendent of Documents for each one that they want. Perhaps the Department of Commerce, as might be expected from its name, is a more businesslike branch of the Federal government than the Department of the Interior.

For many years, most publications of both the United States and the Canadian governments have been distributed to applicants in either country free of charge. Recently, there has been more of a tendency to put a price on them. And why not? Why should not the cost of a valuable government report be partly defrayed by those who get the benefit of it? To cover the entire cost of governmental activities by general taxation in one form or another, and then to dispense the products of such activities with a free hand, is not conducive to economy and the conservation of useful effort.

The only good argument that comes to mind against putting a price on all government publications is the trouble occasioned in sending small sums through the mails. Postage stamps are not honored by the Superintendent of Documents, who sells most government publications in the United States, and of course are useless for international payments. A money order for 5 or 10c. may cost as much as it is worth, to say nothing of the trouble in getting it. Coupons are available from the Superintendent of Documents, each worth 5c., at the rate of twenty for a dollar, which are useful if one orders frequently, or if one happens to have some on hand when a bulletin is wanted. But what is the inquirer to do if he wants a state or provincial publication? Presumably he usually sends a coin, with the obvious chance of loss and the even more obvious lack of enthusiasm on the part of the recipient if he happens to be in a foreign country. An international fractional medium of exchange for sums from one cent to a dollar would be useful.

Who Gets the Goose's Golden Eggs?

IF WE CANNOT HAVE good fortune ourselves, it is helpful and satisfying to contemplate the misfortunes of others. Mining companies in the United States have their tax problems to worry about, but they, at least, do not have two sets of federal taxes to pay in addition to town, county, and state levies. This is just what British companies, operating in countries such as Mexico, have to contend with. British taxes, as is well known, are excessive, for that nation has seen fit to maintain its credit and to pay a fair share of the expense of conducting a great war that its diplomats were not able to prevent; and Mexico, impoverished by revolution, has not been slow in getting all that the traffic will bear out of the exploitation of its natural resources. So the stockholders of The El Oro Mining & Railway Co., Ltd., from the beginning of the war in 1914 to the present time, have had to suffer. In that twelve-year period, the gross profit earned at the mine has been £1,212,808. Of this amount, £465,707, or 38 per cent, has been paid in taxes to the Mexican Government, and £248,245, or over 20 per cent, to the British Government. Out of the remainder, provision for depreciation and other deductions had to be made, so that all the stockholders got of the gross profits was £401,625, or one-third. In other words, for every shilling paid out in dividends, a shilling and nine pence went for taxes.

Evolution of Copper-Ore Concentration at Morenci, Ariz.

Vast Improvement Made in Nineteen Years' Operations—Scrapping of Old Machinery and Flow Sheets Almost a Continuous Process

By Arthur Crowfoot

Superintendent, Concentrating Division, Morenci, Ariz.

COPPER-ORE CONCENTRATION practice at Morenci, Ariz., more particularly in the plant formerly owned by the Arizona Copper Company, Ltd., and now owned by the Phelps Dodge Corporation, has undergone important changes in the last twenty years, not only in metallurgical methods but also in mechanical equipment and results obtained. A brief history of these changes will here be given, and afterward the recent remodeling of the plant and the adoption of the latest practice in copper ore concentration will be described.

The condensed history of the plant is shown in Fig. 1, in which are represented the fluctuations in ore grades, recoveries and tailing losses for the period 1906 to 1920 inclusive, and, as a comparison, the corresponding results for April, 1925. The contrast is obvious, the history is interesting, and the major changes are worth recording.

The record begins in August, 1906. From January, 1907, until September, 1911, concentrator capacity was about 900 tons per twenty-four hours. The peaks of maximum capacity during this period were 1,006, 889, 902, 946, and 984 tons. The low points were 792, 821, 887, and 843 tons. Between August and October, 1911, the capacity was stepped up to 1,600 tons per twenty-four hours and maintained approximately at this figure until December, 1913. The peaks of maximum capacity for this interval were 1,609 and 1,694 tons, and the minimum was 1,196 tons. As a result of remodeling the concentrator in 1913 and 1914, there was a steady increase in capacity up to 3,000 tons per twenty-four hours. In August, 1916, the capacity reached about 4,000 tons per twenty-four hours and was maintained at that figure until 1920.

The more important interruptions to concentrating operations, both partial and total, were as follows:

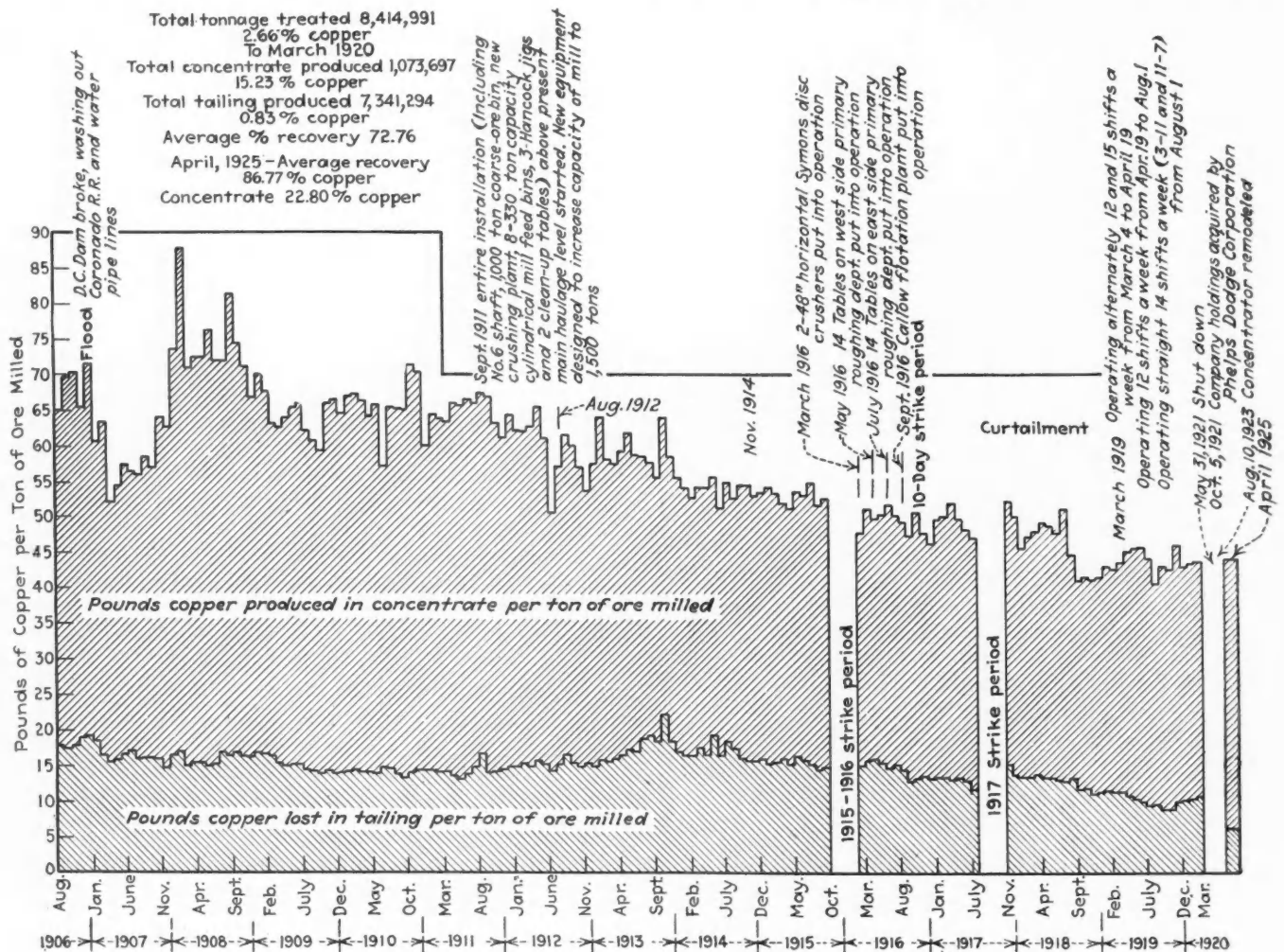


Fig. 1—Copper production and tailing losses Arizona Copper Co., from 1906

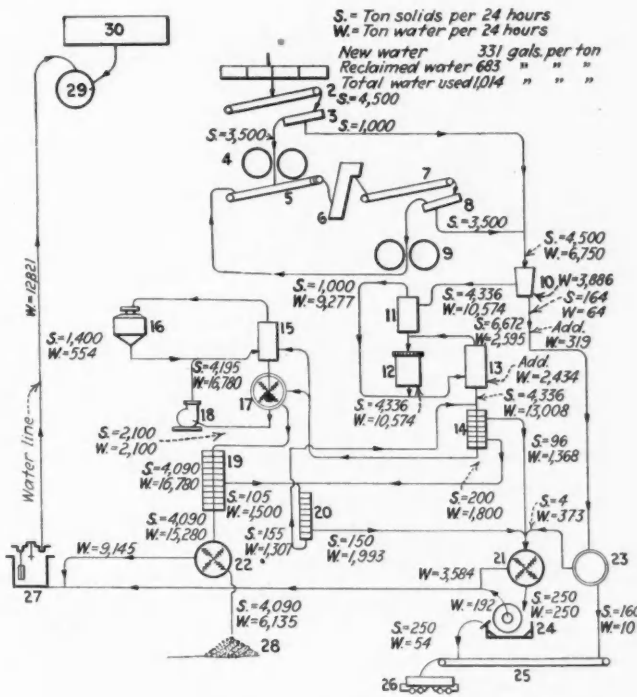


Fig. 2—Flow sheet of 4,500-ton remodeled concentrator Aug. 10, 1923

1. Fine-ore bins—capacity 5,000 dry tons.
2. Conveyor system.
3. Primary Hum-mer screens.
4. Four pairs 54 in. x 24 in. rolls.
5. Roll-product conveyor.
6. Two elevators for roll-product.
7. Conveyors feeding secondary screens.
8. Secondary Hum-mer screens.
9. Four pairs 43 in. x 16 in. rolls.
10. 42 primary tables.
11. Six 6 ft. x 20 ft. Dorr desliming classifiers.
12. Three 7 ft. x 12 ft. A-C. ball mills, two No. 86 Marey mills and one 8 ft. x 4 ft. Hardinge mill.
13. Four 8 ft. x 26 ft. 8 in., two 6 ft. x 25 ft. Dorr circulating classifiers.
14. Eleven Duplex rougher cells (total bottoms 154), 2 ft. 9 in. x 3 ft. 6 in., 1,482 sq. ft.
15. Six 4 ft. 6 in. x 18 ft. Dorr rake classifiers.
16. Six 8 ft. x 36 in. Hardinge mills lagged to 7 ft. x 42 in.
17. Six modified bowl-type classifiers, 14 ft. diameter bowl.
18. Six 3 in. Wilfley pumps.
19. Rougher-cells for secondary flotation, new bottoms = sixty 2 ft. 9 in. x 3 ft. 6 in. = 578 sq. ft. (three new Duplex cells) = old bottoms = one Duplex cell, twenty-eight 2 ft. 9 in. x 4 ft. 0 in. = 314 sq. ft. = forty-eight standard Callow cells 13.43 sq. ft. each = 645 sq. ft. Total = 1,537 sq. ft. Cleaner cells (primary concentrate) thirty standard Callow cells @ 13.43 sq. ft. = 403 sq. ft. Secondary concentrate, nine old bottoms 2 ft. 9 in. x 4 ft. = 101 sq. ft. Twelve standard Callow cells @ 13.43 sq. ft. = 161 sq. ft. Sixteen new bottoms 2 ft. 9 in. x 3 ft. 6 in. = 154 sq. ft. Total = 416 sq. ft.
20. Dorr thickener tanks, for flotation concentrate. Thirteen 30 ft. diameter @ 707 sq. ft. each = 9,191 sq. ft. Two 45 ft. diameter @ 1,590 sq. ft. = 3,180 sq. ft.
21. Two 50 ft. diameter @ 1,963 sq. ft. = 3,926 sq. ft. One 60 ft. diameter @ 2,827 sq. ft. Total, 19,124 sq. ft. Dorr thickener tanks for tailing; one 200 ft. diameter = 31,416 sq. ft. Two 60 ft. sq. @ 3,600 sq. ft. = 7,200 sq. ft. One 130 ft. diameter = 13,273 sq. ft. Total, 51,889 sq. ft.
22. Eight 18 ft. diameter x 7 ft. 11 in. granular concentrate settling tanks. Capacity, 152 tons each.
23. Oliver continuous filter system.
24. Two 11 ft. 6 in. diameter x 12 ft. face, one 11 ft. 6 in. diameter x 8 ft. face. One 14 ft. diameter x 14 ft. face. Total area, 1,338 sq. ft.
25. Concentrate loading conveyor system.
26. Railroad cars for mixed granular and flotation concentrate.
27. Pump system for reclaimed water.
28. Tailing, stock dams.
29. Tank system for concentrator water.
30. Reservoir for fresh water. Capacity 3,000,000 gallons.

Late in 1906 a flood broke the Detroit Copper Co.'s tailing dam and washed out water-supply pipe lines, stopping operations for two months. In September, 1911, the entire installation, including the surface equipment at No. 6 shaft, a 1,000-ton coarse-ore bin, new crushing plant, eight 330-ton cylindrical steel concentrator feed bins, three Hancock jigs, and two clean-up tables above the main haulage level, was started. This equipment was designed to increase the capacity of the concentrator to 1,500 tons per twenty-four hours. From August, 1912, to November, 1914, the concentrator was

remodeled to treat ultimately 3,000 tons per twenty-four hours. From September, 1915, to February, 1916, there was a complete cessation of operations, owing to a strike in the Clifton-Morenci district. In March, 1916, two 48-in. horizontal Symons disk crushers were added. In May, 1916, a primary roughing division, consisting of fourteen tables on the west side of the concentrator, was put into operation. In July, 1916, the east side of the primary roughing plant, consisting of fourteen tables, was started. In September, 1916, a Callow flotation plant was added. During November, 1916, there was a ten-day strike period and from July to December, 1917, another strike occasioned a complete shutdown.

Beginning in March, 1919, concentrator operation was curtailed to twelve and fifteen shifts, alternating per week. From April, 1919, to August, 1919, additional curtailment was made on the basis of twelve shifts per week. In August, 1919, operation was resumed on the basis of fourteen shifts per week. This briefly covers the major events in the history of the plant, omitting, however, the recent changes.

IMPORTANT CHANGES IN FLOW SHEETS

In the flow sheet of July, 1907 (900 tons' capacity), stage crushing and stage concentration, with the removal of as much liberated mineral as possible at each crushing stage, was characteristic. Coarse crushing was effected by two 18x36-in. Blake crushers set to 3 in., followed by two 16x42-in. rolls set to 1 in. Revolving trommels (three 4x9 ft.) received the flow from shaking feeders and divided it into minus 1½ plus ½-in., and plus 1½-in. sizes, the last being returned to the rolls. Fine crushing was effected by three groups of 6-ft. Huntington mills; the first group consisting of four, with

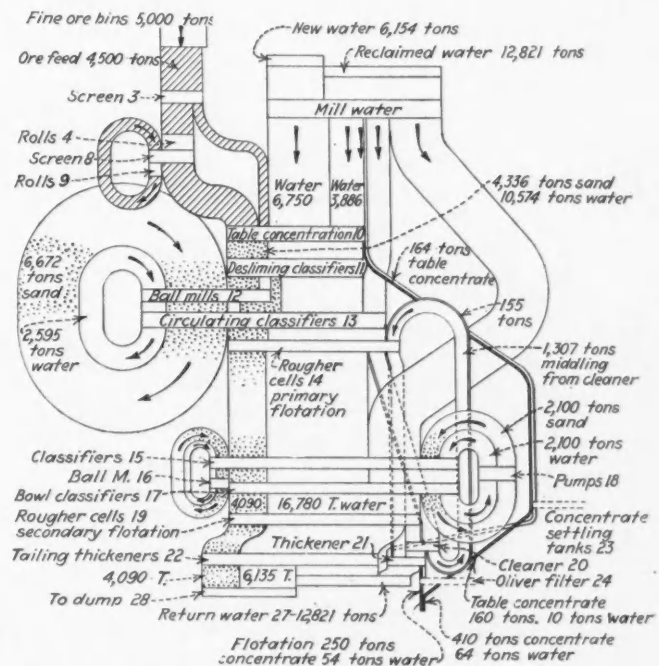


Fig. 3—Quantitative flow sheet, Morenci concentrator

The flotation concentrate cleaning system has been changed since this drawing was prepared. From the primary rougher cells the rough concentrate goes to the cleaner cells and the tailing to the secondary grinding and classifying system. The clean concentrate from the cleaner cells goes to the dewatering system and the middling is returned to the primary rougher cells. The rough concentrate from the secondary flotation goes to secondary cleaner cells and the tailing to the tailing dewatering system. The concentrate from the secondary cleaner cells goes to the first cleaner cells and the middling to the secondary grinding and classifying system.

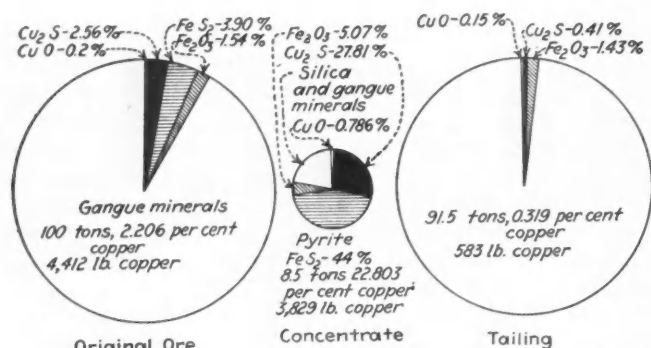


Fig. 4—Average content of ore, concentrate, and tailing in April, 1925

5-mm. screens; the second, three with 2-mm. screens; and the third, two with 1½x1-mm. screens.

Coarse concentration was effected by a double-compartment Harz jig receiving the minus 1½ plus ¾-in. size, and discharging middling-tailing to the first group of Huntingtons, and by three groups of Hancock jigs—the first group consisting of two jigs receiving the minus-¾-in. trommel size and delivering tailing to the first group of Huntingtons; the second group of two jigs receiving the crushed product from the first group of Huntingtons and delivering tailing to the second group of Huntingtons; the third group of two jigs receiving the crushed product from the second group of Huntingtons and discharging tailing to a cone separator, the underflow making the feed to the third group of Huntingtons. In each of the three groups of Hancock jigs, the first three cells discharged finished concentrate; the next two middling, which was returned to the respective jigs, and an overflow which went to twelve conical-bottom wooden settling tanks, the discharge from the bottom of these tanks going to six Wilfley tables, which recovered concentrate and sent the tailing to the dewatering system.

The discharge from the third group of Huntingtons, together with the overflow from the cone separator, was elevated to a four-compartment hydraulic classifier. The first spigot (coarse) was divided, part going to a row of Wilfley tables operating at 240 r.p.m. and part

going to the first row of vanners operated at 200 r.p.m. The second spigot (medium) went to the second row of vanners operated at 190 r.p.m., and the third and fourth spigots (fine) discharged to the third row of vanners operated at 190 r.p.m. Middling from the coarse feed Wilfley tables was handled on two clean-up Wilfley tables. All tables made finished concentrate.

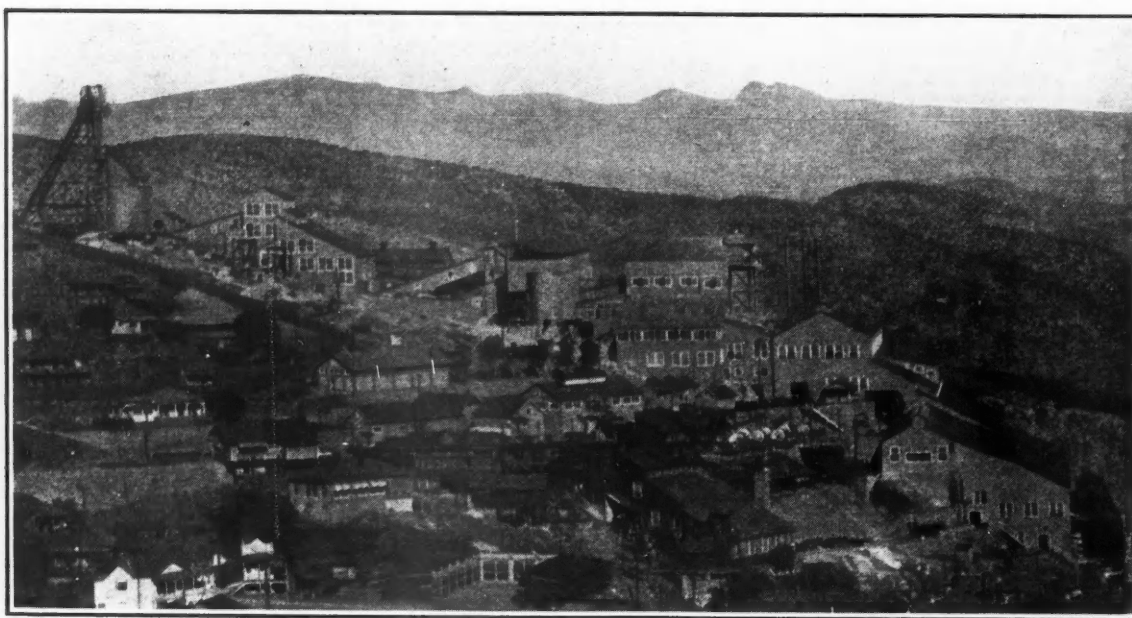
Water conservation was a feature. All overflows from the jigs were received in twelve conical-bottom wooden tanks, the overflows from which were returned to the concentrator supply tanks. All tailings from fine concentration, together with water, were discharged into four cone separators, the overflow being divided and passed to twenty concrete conical-bottom settling tanks. The underflow from these tanks, together with the underflow from the four cone settlers, was run into a four-compartment, circular, reinforced-concrete settling tank, 14x140 ft., the settled tailing being used for filling stopes and the overflow being returned to the concentrator water-supply tanks.

All concentrate was laundered to bins, the overflow from the bins going to a wooden settling tank the overflow from which was received in a tank from which the clear water was returned to the head of the concentrator. Thus the principal water loss was by evaporation, leakage, and the interstitial water in concentrate and tailing.

REMODELING IN 1912-1914

In 1912, the plant was completely remodeled. Two 1,600-ton concrete ore bins were added. Three Hancock jigs were replaced by eight two-compartment Woodbury jigs. The clean-up tables were increased from two to eight. Four stationary screens and four sets of 42x16-in. dry-crushing rolls were added. The wet-crushing rolls were increased from six to nine sets, and nine 36-in. dewatering shovel wheels and eighteen zigzag screens were installed.

Four Hancock jigs were replaced by twenty-four roughing and twelve clean-up tables. Seven Huntington mills and one Chilean were replaced by twelve 8-ft.x 36-in. Hardinge pebble mills, six drag-belt classifiers (replacing sand wheels) being installed before the



The Morenci concentrator

Hardinge mills. Thirty National roughing, sand, and slime tables were replaced by twelve Deister sand tables and twenty Wilfley tables. The vanner feed tanks were replaced by 24-in. wide belt "colloid separators." Two concrete settling cones and ten 10-ft. wooden settling tanks for tailing were added, as well as eight 18-ft. concrete, concentrate settling tanks. The 130-ft. tailing settling tank was remodeled and equipped with Dorr thickener mechanism. These changes extended through to November, 1914, under David Cole, who was engineer in charge.

FLOW SHEET OF 1914-1915

Preliminary crushing, in the flow sheet of November, 1914, was by a No. 8 McCully gyratory and 54x24-in. rolls, the rolls being fed the gyratory product after this had passed through 4x12-ft. trommels with $\frac{3}{8}$ -in. openings. To this point the crushing was performed in open circuit. Secondary crushing was effected in four sets of 42x16-in. crushing rolls in closed circuit with stationary screens, establishing the concentrator feed size at minus $\frac{3}{8}$ -in. Separation was by gravity concentration in four stages.

The first stage was effected by eight Woodbury jigs which produced finished cup concentrate, sent direct to concentrate bins, a slime and fine sand product which was sent to two drag-belt classifiers which discharged sand to the finishing roll system and slime to colloid separators, a hutch product which was sent to eight clean-up Wilfley tables, and a middling-tailing which was sent, with the same product from the clean-up Wilfleys, to the finishing roll system.

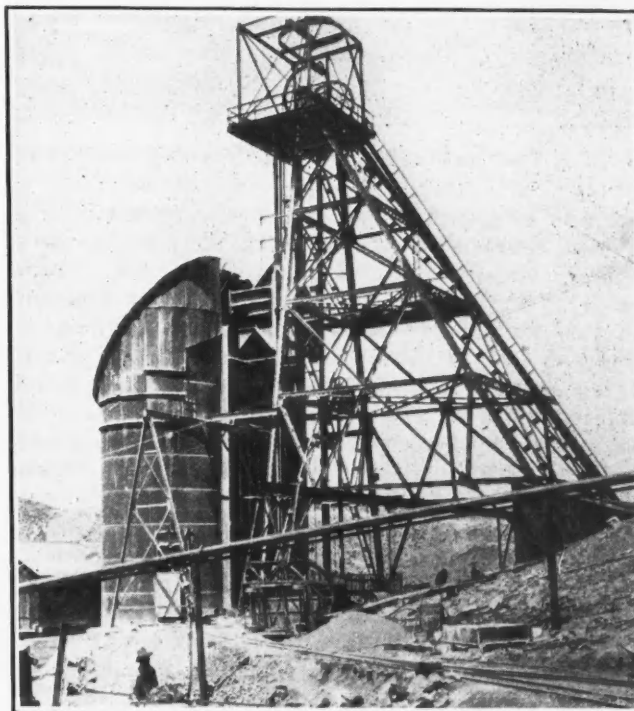
Nine concrete tanks, each equipped with a shovel wheel, received the middling-tailing product from the jig and table system. The sand wheel product was sent to nine sets of 42x16-in. rolls, discharging upon zigzag screens, the underflow of the tanks bypassing the rolls and going direct to the screens. Screen oversize of plus-7-mesh size was returned to the rolls.

The undersize was sent to the second concentration stage, consisting of roughing and clean-up Wilfley tables. Tailing was laundered to six drag-belt classifiers. Coarse sand was ground in twelve 8-ft.x36-in. Hardinge pebble mills discharging into six drag-belt classifiers. A second series of six drag belts received the intermediate product of the first and delivered a sand product to the third concentration stage, consisting also of roughing and clean-up tables. The tailing product of the roughing tables was sent to waste, the middling and tailing product of the clean-up tables going to the last concentration stage. All fine or slime overflows of classifiers were sent to five "colloid separators," which sent fine slime overflow to waste and a sand-slime belt product to twenty-four Isbell and seventy-nine Frue vanners, the last stage of concentration. All sand tailing from tables was sent to two concrete settling cones, which discharged a heavy sand spigot to the tailrace and an overflow containing fine sand to twenty 9.5-ft. inside diameter concrete settling tanks, which discharged an underflow to the tailrace and a clear water overflow, which was pumped back for re-use.

All vanner tailing was sent to twenty 9.5-ft. inside diameter and ten 10-ft. inside diameter wood settling tanks, which discharged an underflow to the tailrace and a clear water overflow, which was pumped back for re-use. All "colloid separator" overflow was sent to the 130-ft. Dorr thickener, where similar work to that mentioned above was performed. Concentrate, except

jig concentrate and table concentrate produced from jig hutchwork, was laundered to eight 18-ft. diameter concrete settling tanks equipped for vacuum drying, the overflow being received in three 16-ft. settling tanks, clear water being returned for re-use. The concentrator treatment represented at the time a consistent application of stage concentration and the roughing and cleaning principle. As will be noted from Fig. 1, no material reduction in tailing content was made, for the reason that considerable loss in fine mineral occurred in the untreated slime overflows.

The application of the flotation process in copper con-



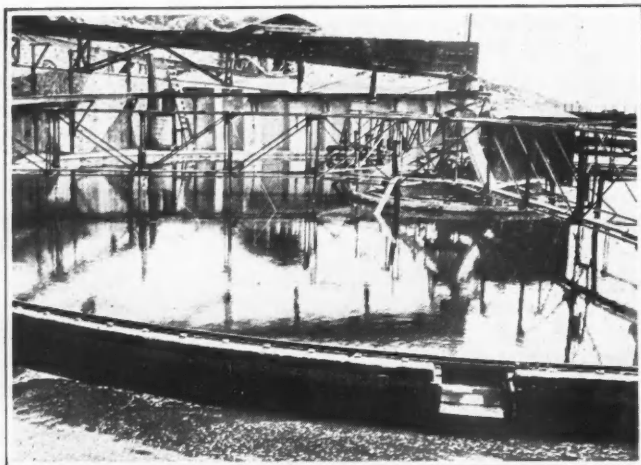
Ore delivery at Morenci concentrator

centration was at this time beginning to attract general attention, and the concentrator flow sheet was left open for the treatment of these fine slimes by the flotation process as soon as experiments could be made and a design accepted for the installation of a flotation system. Experimental flotation treatment using various types of flotation machines was started during 1914.

FLOW SHEET OF 1919

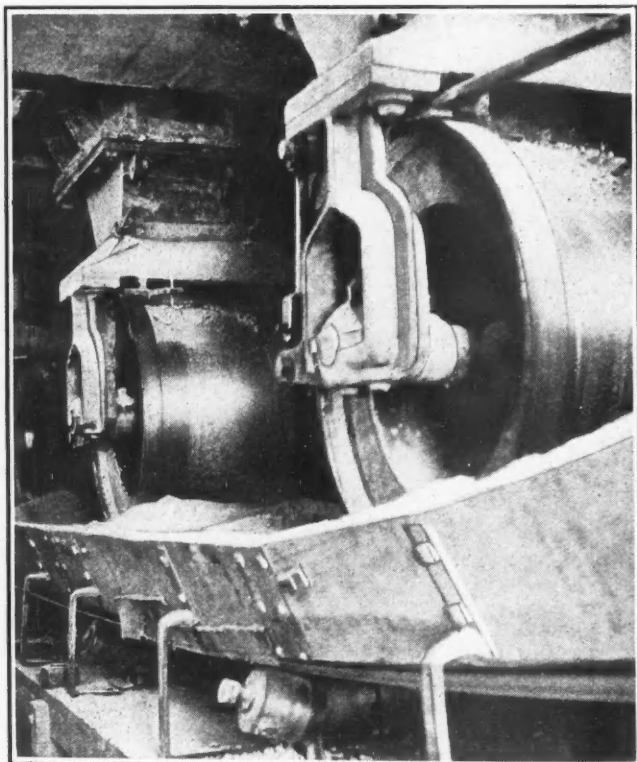
I was placed in charge of the concentrator on Jan. 1, 1915, and during the period 1915-19, various changes were made in the flow sheet, necessitated by a more finely disseminated copper content, increased tonnage requirements and other factors. The work was interrupted by the general strikes occurring in the district in 1915 and 1917. In September, 1916, a Callow flotation plant was put in operation. The tailing copper content (Fig. 1) indicates a slight drop. In spite of irregular operation, the tailing copper content continued to drop until it reached a minimum of 8 lb. per ton in 1919. The lowest tailing during the period of gravity concentration was about 13 lb. per ton. The following changes are shown for the 1919 flow sheet:

Coarse crushing was effected in three stages—gyratory, Symons' disk crushers, and rolls. Final dry crushing to 0.28-in. screen size was effected by rolls in closed circuit with Tyler whip-tap screens. All under-



Part of the dewatering system, Morenci concentrator

size was laundered to two mechanical distributors and divided between two banks, each of fourteen No. 5 Wilfley tables, making finished concentrate. Tailing was sent to twelve zigzag 6-mesh (0.12-in. opening) screens, the oversize going to the sand wheels and thence to nine 43x16-in. rolls discharging upon eighteen zigzag screens (7 mesh), oversize going back to rolls and undersize to two mechanical distributors. Concentration was effected on thirty-six No. 4 Wilfley tables equipped with Butchart riffles. These made finished concentrate and a tailing, which was laundered to twelve 4½-ft. Allen cones, the sand underflow being sent to twelve 8-ft.x36-in. Hardinge mills in closed circuit with Dorr classifiers. These Hardinge mills were the original pebble mills converted into ball mills. The Allen cone overflow was sent to four 30-ft. diameter Dorr thickener tanks, which returned the clear water overflow for re-use, the underflow joining the Dorr classifier overflow and being sent to the Callow flotation

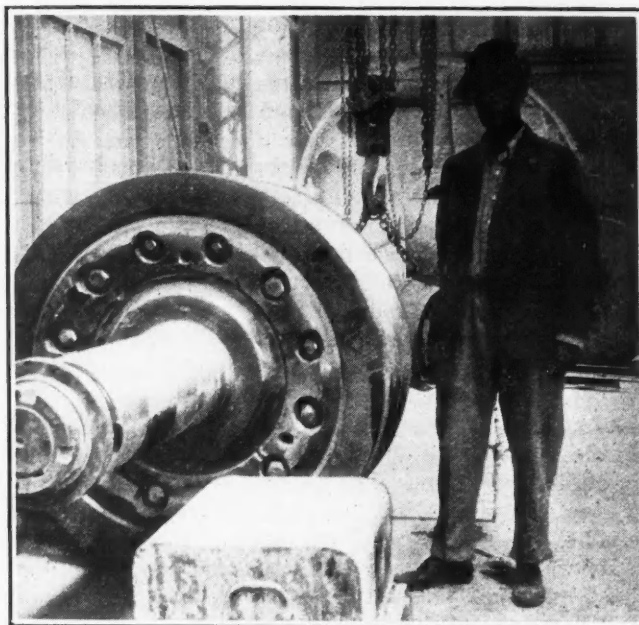


Feeders delivering ore stream to mill

cells. These were arranged in a group of seventy-two standard rougher and eighteen standard cleaner cells, producing finished concentrate, and tailing which, as a return middling requiring re-treatment, was sent back to the classifiers. The tailing from the rougher cells was given a finishing concentration treatment on vanners and Wilfley tables.

The table and vanner tailing was dewatered in five 30-ft.-square concrete tanks equipped with Dorr mechanism and twenty concrete tanks 9½ ft. in diameter, the overflow going to a pump sump and being returned for re-use, and the underflow product going to the tailrace. In addition, two 60-ft. square concrete tanks equipped with Dorr mechanisms and the 130-ft. Dorr tank were used for tailing dewatering.

The vanner and flotation concentrate was dewatered



Arthur Crowfoot, beside one of the roll units

in one 50-ft., one 60-ft., and one 30-ft. Dorr thickener tanks, the underflow being dewatered by two 11½x12-ft. Oliver filters. In this, as in the previous flow sheet, concentration was effected in four stages, one of which was flotation. The use of jigs was a thing of the past. The comparison of the concentrator feeds, recoveries, and tailing losses are given in the accompanying table for the period 1906 to 1920. The total tonnage handled for the period ending with February, 1920, and beginning August, 1906, was 8,414,991 tons, averaging 2.66 per cent total copper. The total concentrate produced was 1,073,697 tons, averaging 15.23 per cent copper. The tailing weighed 7,341,294 tons and averaged 0.83 per cent copper. The average percentage recovery was 72.76. The ratio of concentration was 7.83 tons into 1. On an average, about 20 per cent of the total copper content of the ore occurred in the acid-soluble form, chiefly as carbonates and oxides.

Acid-soluble copper content of ore ranged from 0.35 to 0.45 assay per cent.

EXPERIMENTAL WORK IN FLOTATION

In September, 1918, an experimental mill was constructed, capable of handling between 350 and 400 dry tons of ore daily, primarily for the treatment of development ore from the low-grade sulphide orebody of

December 5, 1925

Comparison of Concentrator Feed, Recovery and Tailing

Year	Concentrator Feed Per Cent Cu		Per Cent Cu Recovery		Per Cent Cu in Tailing	
	Highest	Lowest	Highest	Lowest	Highest	Lowest
1906.....	3.52	3.50	74.97	71.12	1.08	1.02
1907.....	3.50	2.60	77.50	69.57	1.05	0.88
1908.....	4.40	3.20	80.41	75.50	1.08	0.92
1909.....	3.40	2.97	79.09	73.67	1.02	0.84
1910.....	3.57	2.86	80.08	73.98	0.91	0.82
1911.....	3.57	3.00	79.86	74.89	1.00	0.78
1912.....	3.28	2.53	75.80	70.94	0.95	0.80
1913.....	3.20	2.77	75.17	64.94	1.27	0.90
1914.....	2.78	2.60	71.09	65.05	1.08	0.90
1915.....	2.71	2.55	72.10	68.98	0.95	0.85
1916.....	2.58	2.38	73.73	67.56	0.92	0.725
1917.....	2.61	2.34	74.78	72.77	0.87	0.68
1918.....	2.61	2.07	74.32	69.80	0.80	0.65
1919.....	2.30	2.03	78.65	72.50	0.675	0.45
1920 (a).....	2.18	.....	75.30	.....	0.60	.....

(a) Up to February, 1920

the Clay mine. All flotation at minus 48-mesh size was first tried out, followed by table treatment of flotation rougher cell tailing. Later, when it appeared possible that a use for sulphuric acid for leaching might develop in the district, a primary table floor was installed for the recovery of a granular pyritic concentrate. Then, the use of tables for a finishing treatment of flotation tailing was abolished, these being replaced by additional flotation cells following a small secondary grinding installation for reducing primary flotation tailing to a minus-65-mesh size. A sulphide copper tailing of 0.10 per cent was obtained on a feed ranging from 1.10 to 1.4 per cent total copper. These experiments are described in *Engineering and Mining Journal* of June 19, 1920, p. 1,394, and need not be further discussed.

After curtailed operation beginning in 1919, the concentrator was shut down on May 31, 1921, and in October of the same year the Arizona Copper Company, Ltd., was acquired by the Phelps Dodge Corporation. In the meantime, a part of the west section of the concentrator had been remodeled to conform as closely as possible to the flow sheet developed in the experimental mill, and work was started on Aug. 7, 1921, on the treatment of around 300 tons of ore daily from the fire zone of the Coronado mine. By the end of the year this tonnage was increased to about 400 tons daily.

During 1922, part of the concentrator was operated continuously under the conditions of the new flow sheet, treating for the most part accumulated stockpile ore. By December, 1922, the capacity of the unit had been increased to 1,400 tons daily. During this period the ore treated averaged 2.18 per cent total copper, of which 0.33 per cent was acid soluble. The recovery made was 82.96 per cent of the total copper and 92.41 per cent of the sulphide copper. Early in 1923 I was instructed to prepare plans and estimate of cost for remodeling the concentrator to a capacity of 4,500 tons daily under the conditions of the new flow sheet. A condition of the remodeling was that the capacity of 1,400 tons daily was to be maintained during the reconstruction work and was to be increased as quickly as the installation of new units made this possible.

The work of remodeling was started in April, 1923. The daily tonnage was gradually increased until 1,950 tons were being treated in October and 2,200 tons in December, 1923. The work of remodeling was completed in July, 1924, bringing the capacity of the plant to 4,500 tons of ore daily. The expense of remodeling was \$500,000.

No changes were made in the coarse-crushing division. The flow sheet after the fine-ore bins is shown in Fig. 2 and Fig. 3. As will be noted, the whole plan of ore treatment has been simplified. Primary coarse concentration by tables is retained, and no further treat-

ment by tables is made. Flotation is in two stages. Fine grinding is effected in two stages separated by primary flotation. The details of the equipment are given in the flow sheet summary.

The ore from the Humboldt group of mines at Morenci, which is being treated at present, is hard and siliceous. It is higher in grade than the more distinctly "porphyry" ores and is also materially harder. Roll crushing has been satisfactory and fine grinding to about 6 per cent plus 65-mesh screen and about 68 per cent past a 200-mesh screen requires a larger number of ball mills than in the case of softer ores. The use of xanthate as a flotation reagent, which was begun in February, 1925, has improved operating conditions and has diminished the tailing loss.

In Fig. 4, the operating results for the month of April, 1925, are shown graphically. The total copper tailing content was 0.32 assay per cent, of which 0.13 per cent was acid soluble copper, indicating that the sulphide copper content remaining was equivalent to about four pounds per ton, or 1 part in 500. Finer grinding will undoubtedly reduce this and may prove to be economic; this question is now under discussion.

Table concentration for April, 1925, indicated an extraction of 37.34 per cent, primary flotation 42.45 per cent, and secondary flotation 6.98 per cent of the original feed copper, a total of 86.77 per cent, or 91.11 per cent of the sulphide copper. For the same month the power consumption was 14.09 kw.-hr. per ton and the labor ratio was 22.71 tons per man-shift. The flotation reagents were used in the proportion of 0.113 lb. of xanthate and 0.061 lb. pine oil per ton. The concentration ratio was 11.9 tons into 1. The fresh water required was 330 gal. per ton and the total water, 1,572 gal. per ton of table concentrate.

Analysis of Feed, Concentrate, and Tailing for April, 1925

Assay Per Cent	Feed	Concentrate	Tailing
Total copper.....	2.206	22.803	0.319
Acid-soluble copper.....	0.161	0.628	0.120
Sulphide copper.....	2.045	22.175	0.199
Iron.....	2.90	24.08	1.00
Sulphur.....	2.60	29.1	0.20
"Insoluble".....	.....	18.98	.....
Silica.....	63.30	14.20	67.80
Alumina.....	16.80	3.80	18.0
Lime.....	0.60	0.50	0.60
Magnesia.....	0.60	0.50	0.60

The following figures for the five-month period May to September, inclusive, are presented to show gradual improvement since April in reduction of tailing loss, water consumption, "insoluble" in concentrate, and other factors:

	May	June	July	Aug.	Sept.
Dry tons per cent of ore concentrated	125,901	126,462	124,385	136,646	115,635
Assay per cent total Cu in feed.....	2.123	2.216	2.249	2.227	2.239
Assay per cent a.-s. Cu in feed.....	0.166	0.206	0.219	0.176	0.183
Assay per cent total Cu in concentrate	22.322	21.630	22.784	22.069	21.975
Assay per cent a.-s. Cu in concentrate	0.597	0.628	0.705	0.623	0.509
Assay per cent total Cu in tailing.....	0.313	0.313	0.304	0.292	0.302
Assay per cent a.-s. Cu in tailing.....	0.129	0.165	0.173	0.132	0.151
Assay per cent sulphide Cu in tailing	0.184	0.148	0.131	0.160	0.151
Per cent recovery, total Cu.....	86.47	87.12	87.63	88.071	87.718
Per cent recovery, sulphide Cu.....	91.37	93.27	94.07	92.933	93.312
Ratio of concentration, tons into one	12.16	11.21	11.56	11.25	11.19
Kw.-hr. consumed per ton of ore...	14.31	14.09	14.31	13.5	14.00
Gallons of fresh water per ton of ore..	302	293	278	282	281
Gallons of total water per ton of ore..	1,388	1,290	1,248	1,129	1,279
Tons treated per man-shift.....	23.75	25.34	23.30	25.79	24.28
Assay per cent iron in concentrate..	24.68	24.47	23.3	26.20	27.21
Assay per cent in "insol" concentrate	18.07	17.55	17.51	15.44	14.66
Xanthate, pounds per ton.....	0.095	0.107	0.099	0.090	0.083
Pine oil, pounds per ton.....	0.074	0.061	0.056	0.055	0.054

Midvale mild steel roll shells are used. The Marcy mills are provided with manganese steel liners and the other mills with locally cast liners. Locally cast, chilled balls are used in all grinding mills, except the two Marcy mills, 3 in. in diameter in the primary grinding and 2½ in. in diameter in the secondary grinding. In the two Marcy mills, chrome steel balls are used. The

ball consumption averages about 2 lb. per ton; liner consumption about 0.15 lb. per ton; total steel consumption in grinding about 2.15 lb. per ton.

An interesting feature of the handling of the concentrate is that no bins are used, the concentrate being conveyed out of the plant continuously throughout the twenty-four hours. The primary table concentrate is laundered to two 4½x18-ft. Dorr rake classifiers operating in series. These classifiers are equipped with vacuum chambers covered with canvas, over which the concentrate is raked and dewatered. The first classifier, which is installed in duplicate, yields a product containing about 12 per cent moisture, and delivers to the second classifier, which reduces the moisture to between 7 and 8 per cent. The first classifier overflow is settled with flotation concentrate; the second classifier has no overflow; its end product drops on a conveyor belt which then passes under the Oliver filter system, receiving the dried product of this system, both products on the one belt being then delivered direct to railroad cars.

The flotation concentrate first receives a rough settling in a 30-ft. Dorr settling tank equipped with rakes set at an angle of about 40 deg. The granular spigot discharge of this tank at about 60 per cent solids goes direct to filters. The overflow of this roughing tank is settled in larger diameter tanks which overflow clear water for re-use and discharge a thickened underflow direct to filters. The plant is also equipped for giving the flotation concentrate a primary treatment on tables, the granular material removed on the end of the tables being sent through the primary table rake classifiers and the side discharge to the flotation dewatering system. This system is used at times when there is an excess of granular material in the filter system.

No fundamental change has so far been made in the 1923 flow sheet. Primary table work has been curtailed to the extent that secondary screen undersize (No. 8 on flow sheet) is no longer tabled, it having been determined last June that this material could be bypassed to the flotation system without affecting the general tailing adversely. Primary screen undersize (3 on flow sheet) is still given primary table treatment, this feed containing a high percentage of the acid soluble copper minerals, a fair recovery of these being made on the tables. The continuance of this primary tabling work depends on the character of the ore to be treated in the future; if the pyrite content of the ore increases to a point which will render the depression of the iron advisable, then primary tabling will be discontinued and an "all flotation" flow sheet resorted to. Another contemplated experiment includes the grinding of the ore to the ultimate required degree of fineness in one grinding circuit, instead of in two as at present.

How a California Company Mines Feldspar

What is probably the largest feldspar property in California is being operated by the Pacific Sanitary Porcelain Co. of Richmond, Calif., according to the report of the California state mineralogist. The deposit is on a ridge south of Cottonwood Creek, about five miles north of Campo.

A massive outcrop of silica and feldspar occurs in the granite, and is from 300 to 500 ft. wide. It strikes northeast and extends for a distance of 1,600 ft. The deposit has been opened up by an opencut 200 ft. in width and about 75 ft. in height. The top of the

outcrop is about 500 ft. vertically above the floor of the opencut. The spar exposed in the face of the opencut is massive and of good quality, being free from impurities. Intermixed with this are veins and boulders of quartz, which are sorted out when mined. The spar is loaded in cars and trammed to an incline chute which delivers it to a 40-ton storage bin. In this chute there is a section of ¼-mesh screen, to eliminate dust and fine material. From bins the material passes over a 1-in. grizzly, oversize going to a 10x20-in. Blake crusher. This is crushed to pass a 3-in. ring. The 3-in. material goes to a revolving screen 4 ft. long, with 3-in. openings. Here water is added to wash the material. The through-size material passes to a revolving screen 8 ft. long, where it is screened to ½-in. size. The oversize from both these screens is sent to belt conveyors, and conveyed to receiving bins.

The plant is operated by a Fairbanks-Morse Y-type gas engine. The company is shipping 1,000 tons per month, which is hauled by motor truck to a siding on the San Diego and Arizona Railroad, one mile east of Campo. Twenty-five men are employed.

Feldspar is used in the ceramic industry, principally in pottery, porcelain, and enamel wares, and also in enamel brick and tile, being a constituent of both the body and the glaze, but more especially the latter. The requirements of the pottery trade demand that in general the percentage of free silica associated with the feldspar be less than 20 per cent and in some cases the potteries specify less than 5 per cent. An important factor also is the iron-bearing minerals, such as biotite (black mica), garnet, hornblende, and black tourmaline, which are frequently present in pegmatites and granites. Feldspar for pottery use should be practically free from these. The white potash mica, muscovite, is not particularly objectionable except that, being in thin, flexible plates, it does not readily grind to a fineness required for the feldspar. Present quotations are from \$4 to \$10 per ton crude, according to quality.

Beryl Occurrences in California

A number of varieties of beryllium minerals are to be found in San Diego County, Calif., according to the California State Mining Bureau, but none have been found in commercial quantities except beryl, which is a silicate of beryllium and aluminum, carrying when pure 57 per cent silica, 19 per cent alumina, and 14 per cent beryllium oxide. Beryl occurs in San Diego County in the pegmatite dikes of the tourmaline-gem district in the northern part of the county. Thus far no commercial shipments have been made except for gem purposes (the pink and aquamarine varieties). To be suitable for commercial purposes it should carry from 10 to 12 per cent beryllium oxide.

After the ore is mined it is ground to pass 90 to 95 per cent through a 200-mesh screen. It should be white in color and free from iron-bearing minerals and metallic iron. The price varies from 4 to 5c. per pound in carload lots, according to demand and the percentage of beryllium oxide.

The chief use at present for ground beryl is as an addition to porcelain products, where it reduces the coefficient of expansion. Beryllium metal is difficult to separate from aluminum. For this reason the mineral phenacite (Be_2SiO_5) would be a more desirable source for the metal, as it carries approximately 45 per cent beryllium oxide.

Tests With Molybdenum Steel Balls at Matahambre, Cuba

Consumption Per Ton of Ore Ground Less for Treated Chrome Steel Than for Untreated—First Cost Slightly Higher

By E. C. Clapp and F. C. Devereaux

Assistant General Manager and Mill Superintendent
Minas de Matahambre, Cuba

IN THE BELIEF that the following experiments, carried out to obtain the comparative value of molybdenum steel balls and the ordinary chrome steel balls, almost universally used as a grinding medium in ball-mill operation, may be of importance to other operators, we wish to submit for publication the results of tests completed at Minas de Matahambre, S. A., in Cuba. When the matter was first called to our attention, it was desired to determine whether a large-scale test would be justified, and the following preliminary test was made:

Six 5-in. chrome steel balls and six 5-in. molybdenum-treated chrome steel balls were bored for identification purposes and placed in one of the Marcy mills in regular operation. After six weeks the twelve balls were sorted out and removed for examination. The chrome steel balls were from 2 to 2½ in. in diameter and the molybdenum treated balls from 4 to 4½ in. As this was a big margin in favor of the treated balls, a sufficient quantity of these were ordered for a mill test.

The large test was conducted in two No. 64½ Marcy mills running under parallel conditions. One mill was loaded with 9,000 lb. of 5-in. chrome steel balls and the other with an equal weight of 5-in. molybdenum-treated chrome steel balls. The moisture in the ball-mill discharge and all other conditions were maintained as near alike as possible. Each mill had an individual ammeter, and the required number of new balls were added daily to maintain the ammeter readings equal.

The following is a tabulation of the results obtained, based on a ton of 2,000 lb.:

	Chrome Steel Balls	Molybdenum Treated Chrome Steel Balls
Hours running.....	1,427.5	1,452.8
Total tons milled.....	11,002	11,220
Total pounds balls added.....	19,980	18,120
Pounds of balls remaining at end of test.....	7,766	9,790
Pounds of balls consumed.....	12,214	8,330
Pounds of balls consumed per ton.....	1.110	0.742
Cost balls consumed per ton.....	\$0.0544	\$0.0453
Cost balls consumed per ton (present prices).....	0.0488	0.0371

On account of the manner in which the tonnage was calculated, the recorded consumption for the chrome

steel balls is lower and for the treated balls higher than was actually the case. Both mills are fed from the same bin, with no facilities for obtaining a separate tonnage for each mill. The total tons crushed was credited to each in proportion to the hours run. The mill with the molybdenum-treated balls had the larger average ball load and so probably crushed the larger tonnage. The mills were run in closed circuit with trommels having a 3-mm. round opening.

The feed was 3-in. maximum size chalcopyritic ore in which the gangue was a hard shale and quartz.

Since this test was made, the molybdenum-treated balls have been used in the coarse-grinding mills, with a saving close to that indicated by the test. During the last few months they have been used in the fine-grinding mills with economies here as well.

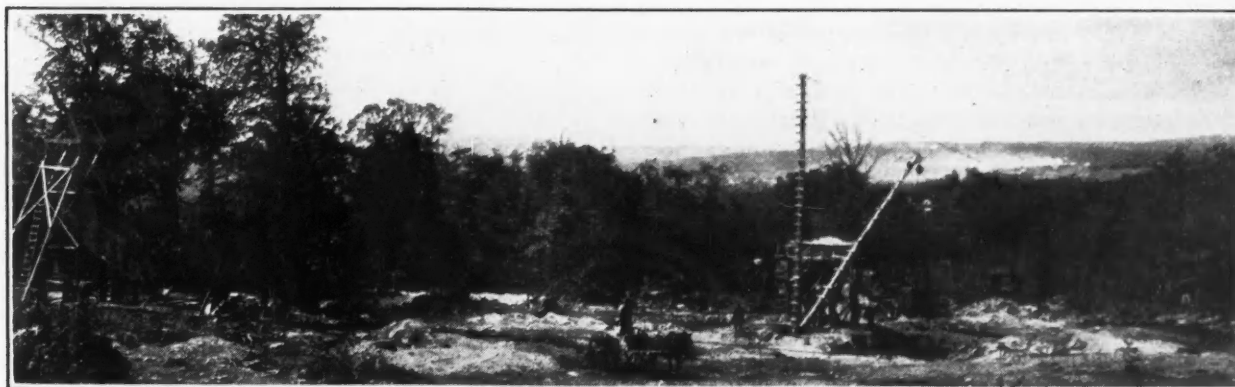
One feature caused some apprehension when these balls were first used. It was noticed that some of the balls split into two parts when in the mills, but this has proved to be of no great importance. The number of balls that will split evidently depends upon the treatment in the manufacture of the balls, for the various lots act differently in this respect. In some lots practically none will split, whereas in other lots up to 2 to 3 per cent will do so. These balls, however, are not lost for grinding, for they do not break again but wear as semi-spheres, until sorted out for use in the fine-grinding mills.

The cost of the treated balls is slightly higher than the untreated, the additional cost at the present time being about 0.6c. per pound.

The saving in the use of the molybdenum-treated chrome steel balls would vary according to locality, but in most cases would be greater than at Matahambre, owing to the exceptionally low freight rate to this place.

Zinc Industry in Tunis More Active

There has been a marked revival of activity in zinc mining in Tunis during the last two years, but as yet there has been no close approach to the statistics recorded for pre-war years, according to *Commerce Reports*. The exports of zinc ore from 1898 to 1913 averaged 33,000 metric tons annually; since then they gradually diminished to 6,100 tons in 1922. The operation of zinc mines in which lead deposits do not exist in important proportions has been discontinued since 1913. In 1923, however, there developed a firmer tone in the zinc market, which continued through 1924. Zinc exports were 12,933 tons in 1923 and 15,824 in 1924.



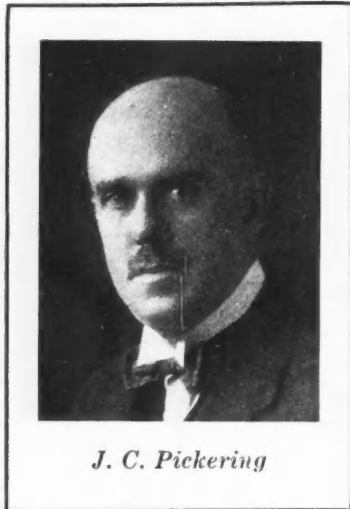
An Asbestos Prospect in the Thetford Mines District, Quebec

Mexico, a Field for Investment

Present Rate of Mineral Production Exceeds Any Previous Record—Many Custom Smelters—Mining Industry Retarded by Revolution—Peaceful Conditions Established

By J. C. Pickering

Mining Engineer, 16 Park Ave., New York City



J. C. Pickering

MEXICO produces 40 per cent of the world's silver and 15 per cent of the world's lead. Her output of gold, zinc, and copper each amounts to less than 5 per cent of the world production; not so important, it is true, but substantial, aggregating, when translated into money, about forty million dollars a year. As a silver producer, Mexico leads the world, with an annual output not far from 100,000,000 oz. The United States comes second. The value of Mexico's 1924 production of metals exceeds any previous record, not excluding the best years under President Diaz. The production of silver and lead has, of late, increased so materially that small declines in the output of gold and copper are completely eclipsed when totals are considered. Mexico is, therefore, a large factor in the metal markets of the world.

The custom smelters of Mexico, with an annual capacity of about two and one half million tons, have perhaps played a leading rôle in promoting the growth of the mineral industry. The Morse plant, in Chihuahua, is the largest lead smelter in the world. While impressive tonnages of ores and concentrates are of course purchased, mines owned and operated by the smelting companies form the nucleus of the ore supply. With the exception of the west coast and the southern end of the republic, the mining fields of Mexico are well served by local custom smelters.

Along or adjoining the El Paso-Mexico City railway are located the Morse, Asarco, Torreon, and Aguascalientes plants. Along the eastern side of the central plateau are important smelters at Monterey, Saltillo, Concepcion del Oro, Matehuala, and San Luis Potosi. There are no zinc smelters in Mexico, but a lead refinery and a gold-silver parting plant function in Monterey, and two of the smelters have large arsenic adjuncts. Coke is supplied from the extensive coal fields of the State of Coahuila. Districts which produce large quantities of lead-silver carbonate ores are Mapimi, Santa Eulalia, and Ahumada. In the foregoing review of custom plants the important copper smelters at Cananea, Sonora, and Boleo, Lower California, are not so considered. Neither is the Campo Morado smelter, in Guerrero, now in process of erection by the Lewisohns.

Of the milling camps, Pachuca, only four hours by rail or motor road from Mexico City, is the largest in the republic and the leading silver-producing district of the world. Its growth over the last fifteen years

has been phenomenal. The mills of the camp are today treating about 170,000 tons per month, and a large silver-gold refinery is in operation. The history of Pachuca is one of great mineral discoveries. The rich and persistent Purisima vein of the Real del Monte company, first encountered about ten years ago, is no longer in the limelight, and, from a spectacular viewpoint, has been supplanted by the Dos Carlos vein of the Santa Gertrudis company. At the 16th level, where this vein was first encountered four years ago by cross-cutting, 3,000 ft. of practically continuous ore has been disclosed, with widths of 8 to 20 ft. and better than average values, judged by the standards of the camp. The vein does not appear on the surface. Perhaps commercial ore does not extend above the 12th level, although it certainly continues in depth to at least the 19th level, and probably further and laterally also.

The famous gold camp of El Oro, now approaching exhaustion, continues to mill about 110,000 tons per month, but the margin of profit at the two largest mines—Dos Estrellas and El Oro—is becoming distressingly low. The Fresnillo mine, in Zacatecas—crushing about 110,000 tons monthly of low-grade silver ores—is a great operating success. Next in importance from a tonnage standpoint is Parral, where the American Smelting & Refining Co. is a dominant factor. Silver-lead-zinc ores here predominate. Flotation has assisted materially in giving this camp its present position of prominence: witness the now highly profitable San Francisco mine, whose ores for years resisted successful treatment. Space will not permit a discussion of the numerous other camps and single mines of importance. What has been set forth in the foregoing paragraphs will afford some conception, though incomplete and sketchy, of the scope of operations, both smelting and milling.

Industry in Mexico is so intimately associated with the political fortunes of the country that a brief review of those conditions should not be out of place. For thirty years—between 1880 and 1910—Mexico, under Diaz, enjoyed continuous peace, and, toward the end of that period, unparalleled general prosperity. Tempting inducements were offered foreign capital, and wholesale investments were made in mines, railroads, power projects, oil fields, lands, timber, and cattle. By 1910, therefore, Mexico was a thriving, prosperous country.

Then, with the advancing age of Diaz and his attendant loss of control, came the revolutionary outbreak of November, 1910. It gave impetus to an impending social upheaval which, until then, had been kept under control, and the subsequent march of events was no doubt accelerated and aggravated by the Latin-American tendency to settle political differences by force of arms. The upheaval, which at first centered in the border states, gradually gained headway until the whole country was involved, and the destruction was terrific.

Had not the attention and energy of the world been centered on the European conflict, it is conceivable that the great powers, acting in concert, might have found

some way to assist Mexico in solving, in a peaceful manner, her international problems, thus preventing or lessening the wholesale loss of life and property which ensued.

By 1918, the food supply was becoming a serious problem; industry was almost at a standstill and, through sheer inertia, the series of social upheavals lost headway. Beginning with 1919, during Carranza's régime, there ensued a period of slow repair and reconstruction. This was interrupted in 1920 by the short conflict which resulted in the overthrow of Carranza and the subsequent instatement of Obregon, and again in 1923 by the abortive attempt of de la Huerta to oust Obregon.

Unquestionably a distinction should be drawn between the relatively brief political conflicts of 1920 and 1923, each confined to a few months, and the prolonged, destructive social upheaval which began late in 1910 and lasted, on and off, for eight years. Throughout the latter period a few mining properties, favored by location or management or both, operated continuously or nearly so; others, less favored, adopted a stop-and-go policy. The short revolutions of 1920 and 1923 resulted, with very few exceptions, neither in the cessation of established mining operations nor in the destruction of mining property.

The de la Huerta uprising of 1923 enjoys the distinction of being the only one, within the memory of the present generation, which signally failed in its purpose—namely, the overthrow of an established government. In Mexico this is deemed significant, and is expected to act as a deterrent to future attempts. The action of the United States in supporting Obregon throughout the crisis is noteworthy.

Mexico under Calles is peaceful and active. His is the first administration since Diaz which has balanced the national budget. A respectable cash surplus has already accumulated in the treasury.

A PERIOD OF EXPANSION

When, toward the end of 1918, it was indicated that the series of upheavals had run their course, local mine managers began to counsel expansion. Except in isolated instances, exploratory work was unwise or impracticable during the 1910-1918 period. Many mines had functioned with varying degrees of regularity through these turbulent times, and, in the very nature of things, the acquisition of new properties became, in some cases, imperative—always assuming that the mining companies intended to stay in business, and most of them did.

The stage, therefore, was all set for expansion. Carranza had succeeded in pacifying a large part of the republic; the railroads were beginning to function with some degree of regularity, although still lamentably short of rolling stock; the Mexican Government was bringing pressure to bear on the owners of idle mines in an endeavor to get the country going, keep the unemployed out of mischief by giving them work, and increase revenues through the normal channels of taxation; and last—but not least—many mining companies were anxious to acquire new properties. Then came the silver boom, which gave the necessary stimulus. Between 1919 and 1922 there was an active scramble for mines. Nearly all the major mining and smelting companies formed or expanded exploration departments and actively competed in the acquisition

of new properties. Those companies that were well directed and adequately financed succeeded in all respects in accomplishing their purpose. The properties so acquired have been, or are being, brought into successful operation.

Then followed a period of diminishing activity in so far as the acquisition of new properties was concerned. Several of the more enterprising mining companies had materially reduced their cash reserves in the development and equipment of properties secured. Perhaps, also, company directors felt justified in calling a halt, so far as expansion was concerned, pending the bringing into production of properties obtained. There is not, however, any material slackening of the activities of the two major smelting concerns. I have given in a previous publication¹ my reasons for feeling that a company operating custom smelters is in a decidedly favored position with respect to the acquisition of new properties, and it is not unnatural, therefore, that they should, in effect, lead the field.

TYPES OF PROPERTIES ACQUIRED

Beginning with 1919, many of the leading mining companies of Mexico decided on a policy of expansion, although the immediate background was one of disturbed conditions and political uncertainty. Their desire to confine acquisitions to properties along the railways or near large centers of population was not unnatural. As time went on, however, this spirit of justifiable caution became less pronounced and is today hardly noticeable.

Mines Flooded—Between 1910 and 1918 a great many mines were abandoned, and their workings became flooded. It was not always the isolated properties that were so affected—numerous first-class mines on or near railways suffered a similar fate. Naturally, however, abandonment was more pronounced in remote localities. The governing factors were, as a rule, the financial strength of the owners and their willingness to see the thing through; the location of the property; the possibilities of obtaining suitable fuel or electric power, and last, but by no means least, the management. Unusual tact, courage, patience, and foresight were required to keep things going through those stormy years, and the man on the spot usually had to rely on his unsupported judgment. The year 1919, therefore, found many flooded mines on the market—some of unquestioned merit, others worthless. To receive consideration, evidence of value had, of course, to be produced.

Complete Data Lacking—Complete data was not always available, since many valuable records and plans had been maliciously destroyed by revolutionists, and information from different sources had frequently to be pieced together. Nevertheless, it was usually possible to make a fairly complete preliminary case for or against a property. It goes without saying that engineers were not recommending the outlay of \$50,000 to \$125,000 necessary to provide the facilities, unwater, sample, examine, and partly develop a flooded mine—of, say, 200 to 400 tons per day indicated output—unless there was ample justification for undertaking the expenditure.

Risk High—The element of risk in ventures of this kind is high. On the other hand, such properties are usually considered on terms thoroughly advantageous

¹"Engineering Analysis of a Mining Share," pages 18 and 19. McGraw-Hill Book Co.

to the prospective purchaser; therefore, on balance, good judgment should result in a successful outcome. At times, however, after unwatering, the appearance of and outlook for the orebody, or the mining and metallurgical problem, is found at variance with what had been expected from a careful study of plans and records, made before the risk was undertaken. The personal equation looms large in appraising the value and prospects of a mine.

I have stated that between \$50,000 and \$125,000 may be the initial risk in the type of venture under consideration. Admittedly this is a wide range. In explanation, we must bear in mind that abandoned mines usually suffered severely from vandalism. Unless power lines were close by—not frequently the case—a power plant must be repaired or installed, and in any event, hoisting, pumping, and housing facilities must be provided. Also, if a mine is unwatered and found doubtful, some development is usually undertaken, and this may run into substantial figures before rejection is decided upon.

There is, furthermore, that great element, the unforeseen. I recall one property on which complete assay plans and records were produced, electric power was available, and equipment at the mine in good condition. The inflow of water was given as 50 gal. per minute and the cubic contents of the voids could be accurately calculated from the mine plans and sections. As drainage operations progressed it became evident that new factors were coming into play—for two months over 300 gal. per minute was pumped without materially lowering the water level. When the work was completed the inflow was found, as reported, to be 50 gal. per minute. In seeking the cause of the discrepancy the engineers found, at various points in the mine, open, transverse fissures extending into the country rock, accompanied by considerable local shattering, and it was assumed that a great underground storage basin had been drained. This particular mine failed to meet requirements and was abandoned. The next venture undertaken, however, developed into a valuable property.

Advanced Metallurgy—The application of advanced metallurgy, particularly flotation, has changed the status of many mines in Mexico. Various ores—notably lead-zinc-silver mixtures—deemed valueless in 1910 are today being profitably worked. I have already pointed out that between 1910 and 1918 mining expansion in Mexico was decidedly curtailed, whereas, elsewhere, flotation had received wide application. Consequently, starting with the latter year, Mexican exploration companies benefited by an accumulation of outside experience. That this knowledge was profitably applied goes without saying.

The remaining types of ventures offered are those considered the world over, namely: prospects with possibilities; barely payable mines whose true worth may lie in larger-scale operations, modern management, or improved equipment; properties with metallurgical problems to be solved; low-grade mines whose only chance of success lies in wholesale operations; mines

which will become profitable only through the provision of modern methods of transportation and better facilities.

PROSPECTING NEGLECTED

Prior to 1910 there was much activity, with attendant benefits to the mining industry as a whole, but during the eight years of revolution, prospecting practically ceased, and only over the past few years has renewed interest been shown. As a result, few important mineral discoveries have been made.

Attention has already been called to the disclosure, by underground crosscutting, of those profitable veins, Purísima and Dos Carlos, in the camp of Pachuca. Two additional mineral discoveries of importance are the Erupcion Ahumada lead mine, in Chihuahua, and the Piedra Bola silver mine, in Jalisco. The history of the Ahumada is too well known to warrant description.

Of the Piedra Bola I have a fair knowledge, since I closely watched its growth from a

prospect to a proven mine, and had something to do with its eventually getting into strong hands. About 1918, Dr. Cuthberto Hidalgo, prominent in Mexican politics, organized a small company for the purpose of prospecting and developing certain groups of mining claims. Among the proposals entertained was that of advancing a tunnel, already several hundred feet long and driven on a vein, assay of which gave thoroughly indifferent results. Within 50 ft. of the old heading the oreshot was struck and drifted on continuously for about 900 ft. The discovery was coincident with the silver boom, and the venture, practically from its inception, was a great success. Widths of 6 to 20 ft. prevailed, and the ore, averaging over 25 oz. silver and \$6 gold per ton, was shipped in train loads to the Aguascalientes custom smelter. Eventually, control of the undertaking was directed into experienced hands, and today it is a valuable mine—unique in that there is no evidence whatever of discovery by the early Spaniards.

SIGNIFICANCE OF OLD WORKINGS

The early Spaniards and their successors in interest, collectively, as a rule, described as "los antiguos," are not generally given the credit they deserve. There are but few mines in Mexico that do not show some evidence of their industry. They were wonderful prospectors, miners of no mean ability, and bearing in mind the science of the times, were good metallurgists. Their resourcefulness and ability to overcome obstacles with the primitive means at their disposal were little short of amazing.

Take, for instance, pumping and hoisting. Horse-driven "malacates" usually did the hoisting, ox-hide containers being used to raise water or rock. By working the animals in short relays, at high speed, a very considerable amount could be raised through one opening. With added depth, an increase in the amount of water, or both, additional shafts were sunk, until, in certain camps—if I remember correctly—shafts were spaced less than 200 feet apart. Abundant pasture for

EQUIPPED, as Mexico is, with large custom smelters, railroads which are functioning well, abundant labor, a wonderful climate throughout the central plateau, well-timbered areas, other natural advantages, and mineral wealth which is unquestioned, it would appear that the possibilities of the country cannot fail to receive increasing recognition. As evidence of the growth of the mining industry, the value of Mexico's metal output is today greater than at any time in the history of the country.

animals and the cheap labor made deep operations possible.

It is true that certain complex ores, today amenable to treatment, were to them a closed book. On the other hand, the patio process was a success when applied to the more docile silver ores, and primitive smelters were extensively used. Labor was available in great abundance and was kept, generally speaking, in a condition almost approaching slavery.

When, therefore, one is offered a property—usually flooded or caved—whose sole merit centers on the inefficiency of old-time operations, the venture should be subjected to unusual scrutiny. It has been my experience that the old-timers were decidedly thorough, especially in mining narrow deposits, and not infrequently stayed with an orebody until it was undeniably bottomed. Admittedly, however, they solved only the simpler faulting problems, and were quite unable to treat complex ores profitably, particularly sulphides, unless of very high grade.

IMMEDIATE NEEDS OF MEXICO

Mexico is a country of great mineral wealth—both developed and prospective—and nothing will contribute more to profitable mining expansion than peace, power, and transportation.

Extension of existing electric power lines, the development of new hydro-electric projects, and improved transportation, both by rail and road, will play an important part in the development of the Mexican mining industry. Next to continued political stability, I place these in the front rank.

A glance at a power map of the republic shows great stretches of country dotted with producing mines or mineralized areas not served by electric lines. There are numerous hydro-electric projects which can and will be profitably harnessed, and a great field is open to power companies with vision.

Rail and road construction have been almost at a standstill for fifteen years. It is true that construction now under way will soon connect the Southern Pacific with the National lines of Mexico and provide all-rail transportation between Nogales and Mexico City. This line will make the west coast of Mexico accessible to the remainder of the republic and prove of great importance to both. Owing to lack of through transportation, the mineral wealth of the west coast has not received the attention it deserves.

Good motor highways are practically non-existent. There is crying need for this development, and warrant for feeling that steps will soon be taken which will begin to supply the deficiency. There is a possibility that American standards of construction may be adhered to—thus assuring some degree of permanency.

A few words as to the basis on which mining properties have been and can be acquired may not be out of place. An option to purchase, at a reasonable figure, following an adequate development period, is naturally not uncommon. Generally, in such cases, shipment of ores on a royalty basis is permissible—the royalties to apply on the purchase price if option to purchase is exercised. With good metal markets this feature is often of assistance to the prospective purchaser and may assist him in covering all or part of his outlay in case of abandonment.

Many transactions have taken place on a participation basis; that is to say, the investor is allowed two

or three years for development purposes, within which time he has the option of proceeding with equipment on a pre-arranged scale of so many tons per day, and in return receives 60 per cent of the profits in perpetuity, or over an adequate period, of say twenty-five years, the management, of course, to rest with him. Withdrawal at any time by the investor involves forfeiture of improvements made. A modification occasionally given effect is that the investor gets his money back before there is any distribution of profits, and these are then divided equally. The foregoing participating transactions usually apply to mines in an advanced stage of development. As a rule, for the protection of the owner, operating costs are defined to prevent the property being charged with an unfair proportion of head office expenses. This is not unreasonable. The arrangements described are, to my mind, eminently fair and attractive, particularly the fifty-fifty and sixty-forty participation types.

I do not, of course, wish to leave the impression that in Mexico desirable properties are obtainable on attractive terms without real effort. Well-directed and adequately financed organizations are as necessary there as elsewhere. I need hardly point out that in conducting an exploration company, one courts disaster if an endeavor is made to get immediate results. The acquisition of good mines takes time. On the other hand, ultra-conservatism and failure to take fair mining risks simply consume capital and lead nowhere. Losses will be made, but good mines may cover such losses and leave a wide margin of profit.

Perhaps it may not be out of place to mention that operation in any foreign country is a specialized business, and Mexico is no exception to the rule. Ability to get the most out of Mexican customs, laws, and operating conditions is not acquired without time and effort.

Mexico, to my mind, offers exceptional opportunities for profitable mining investment. Admittedly there has been and is some political risk, but companies with interests in the country—unquestionably those best qualified to judge—have not failed, nor are they failing, to take full advantage of those opportunities. The apathy of outside mining capital with respect to Mexico is, I feel, based on premises not in keeping with the facts and probabilities.

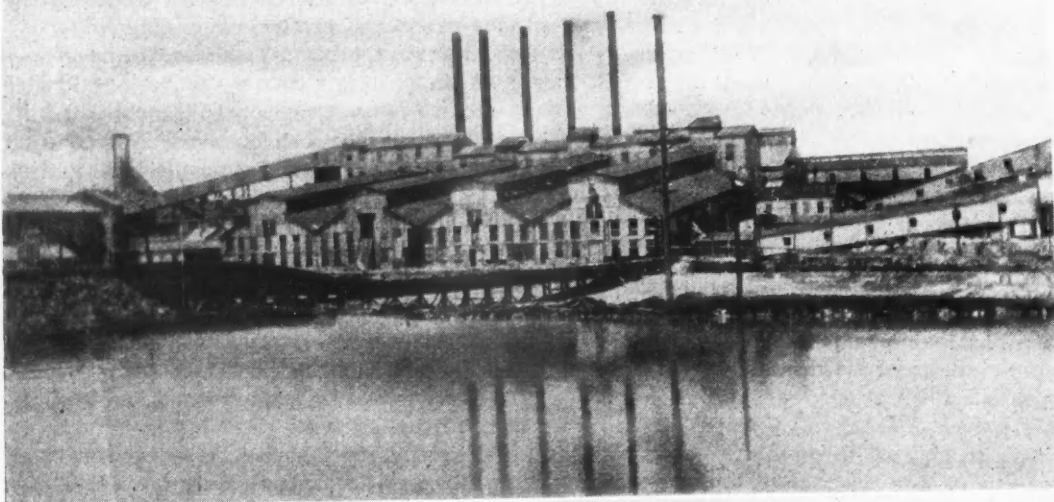
Equipped, as Mexico is, with large custom smelters, railroads which are functioning well, abundant labor, a wonderful climate throughout the central plateau, well-timbered areas, other natural advantages, and mineral wealth which is unquestioned, it would appear that the possibilities of the country cannot fail to receive increasing recognition. As evidence of the growth of the mining industry, the value of Mexico's metal output is today greater than at any time in the history of the country. All well-directed and adequately financed exploration companies operating in Mexico since 1919 have, without exception, succeeded in all respects in accomplishing the purpose for which they were created.

Types of Shovels to Be Limited

A conference of manufacturers, wholesalers, retailers, and users of metal shovels and officials of the simplified practice division of the U. S. Bureau of Foreign and Domestic Commerce, meeting at Atlantic City recently, voted to eliminate more than 4,000 sizes, finishes, and varieties of shovels, the program becoming effective May 1, 1926.

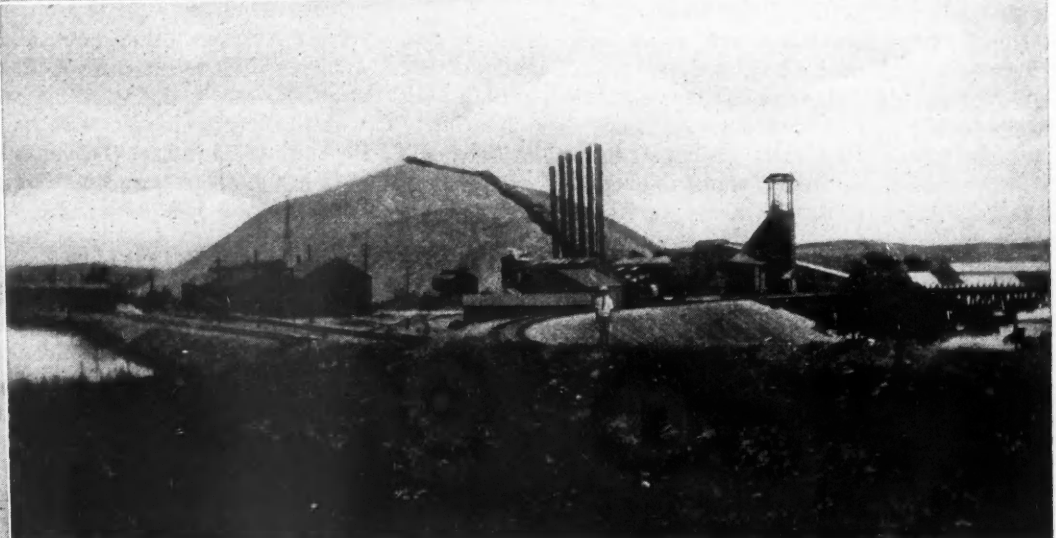
Southeast Missouri *Today and a Quarter Century Ago*

Main Street,
Flat River, Mo.,
as it is today



Main plant of
St. Louis Smelting
and Refining Co.,
at St. Francois, 1925

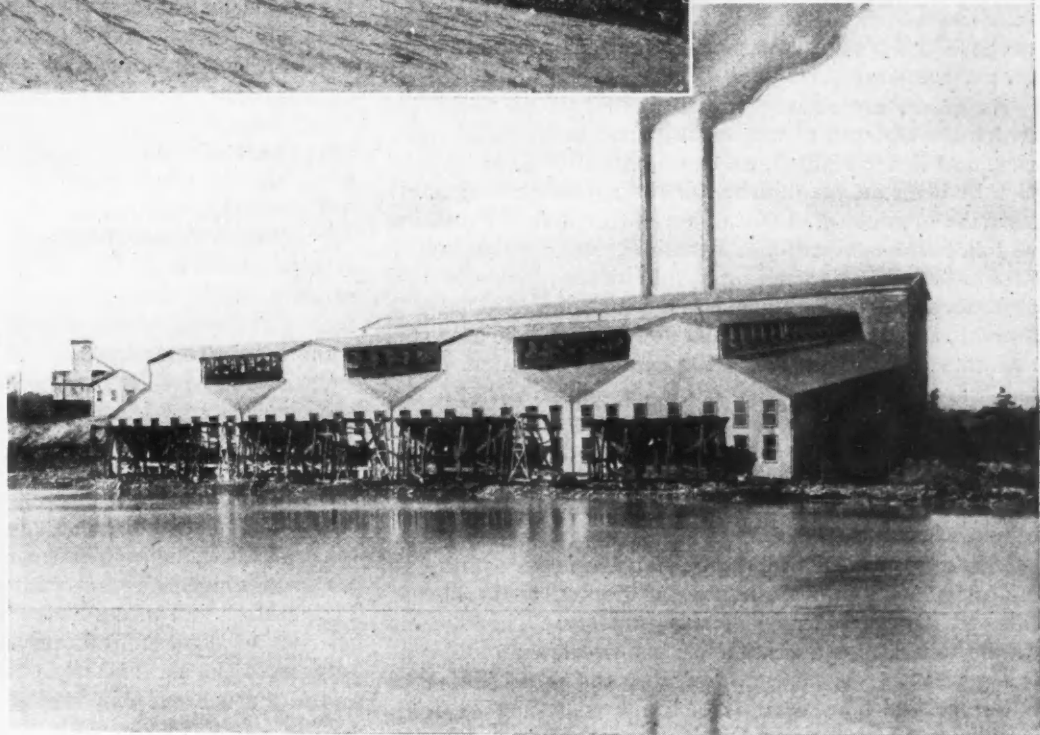
Same plant as
above seen from
another point
Note the tailings
that have accu-
mulated.





Twenty-five years ago in Flat River. Main Street appeared then much as it does today

An earlier view of the St. Louis company's plant. October, 1900



The tailings pile seen on the opposite page had not accumulated when this old view was taken

Discussion

Utah's System of Mine Taxation

THE EDITOR:

Sir—Regarding the Utah system of mine taxation, so interestingly described in your issue of Sept. 12 by George J. Young, one may ask two questions: 1, Is the system consistent with that used for other kinds of landed property? and, 2, Is the system the one best adapted to the development of mining according to the principle of equal freedom for all citizens on which all modern democratic governments are supposed to be founded? I beg leave to first reduce the apparent complexities of the Utah law to their simplest terms as perhaps the quickest method of finding the answer for both these vital questions.

As mines are merely one form of real property (of which the others are urban and rural land, public utilities, and water rights), an examination of mining taxation involves an examination of the nature of real-estate taxation in general. In Utah this latter taxation appears to follow the conventional system of other states, which first estimates the "selling value" of the property and then levies on it for purposes of taxation at a certain annual rate, expressed in mills per dollar. Whether this estimated "value" is really the commercial value, or an arbitrary fractional part of it, is immaterial to the present investigation, since it is clear that what is sauce for the goose is also edible by the gander, and the same factor of reduction could be applied to the commercial value of mines, for tax-levy purposes, as to the value of other forms of real property.

The *actual* value of *developed* urban real estate can be estimated by capitalizing, at the current rate of interest, the *net* income of the property. This income can be found by deducting from the average annual rent the expenses: such as maintenance and depreciation of building, taxation, commissions for collection of rent, insurance, and other incidental charges. Often the *commercial* value differs from this resulting figure by a speculative increment or decrement, based on a guess as to the increase or decrease in the future of the earning value of the lot on which the building stands. Similarly, the potential commercial value of *undeveloped* real estate can be estimated by assuming the lot to be improved with a building suitable to the locality and deducting from the capitalization of the probable net rent a sum to cover the cost of the building. Usually in any growing city this last estimate is needless, as frequent sales of adjoining vacant lots will give a more accurate comparison as to the commercial value of any particular lot—by the application of well-known rules regarding the relative value of street frontages of position near corners or otherwise favorably situated. The adjoining sales will also include in their prices the speculation factor of probable future variations in value, whose increments may be compared in mines with the increase of ore reserves by new developments and whose decrements with their depletion by ore extraction and shipment.

A study of this description of the usual methods of

real-estate valuation will convince any mining man that there would be nothing difficult or vague about applying them directly to the valuation of mineral property, either developed or virgin. In the former case the corresponding *actual* value would evidently be the capitalization of the *net* annual income at the appropriate rate of interest; which income would be obtained by subtracting from the gross proceeds of mineral sales not only the current expenses but items covering the depreciation of all betterments and equipment as well as the depletion of the orebody. Both these last factors would be estimated annually from the probable future life of the mine and the assumed average price for its mineral output. In the case of virgin ground the calculation could be similarly made after assuming the cost of development and equipment for production. However, in the case of certain classes of mineral land, like coal and iron beds, the valuation could often be fixed by comparing any property with recent sales of similar ground near by according to the method used for vacant urban lots.

A practical proof of the feasibility of the suggested method is its success when applied on a large scale in the masterly revaluation of mineral properties made some fifteen years ago by J. R. Finlay for the State Tax Commission of Michigan. "But"—I hear the objection—"Finlay's methods were applied chiefly to great iron and copper properties whose ore reserves were explored and calculable, while in the case of Utah's coal, gold, lead and silver mines the contrary condition prevails." Without dwelling on the huge mine of the Utah Copper Co., that of the Columbia Iron Co., and the numerous soft-coal companies which are without question exact parallels of the Michigan mineral deposits and represent a large portion of Utah's total underground property, I will scrutinize the class of mines mentioned in the objection in order to ascertain if they are indeed beyond the scope of Finlay's methods. Certainly the dealers on the mining stock exchange of Salt Lake City do not think so, if one can judge from the regular and frequent sales of the shares of all the principal producers of these metals. Certainly there is no fairer way to estimate the taxable present worth of a mine than to average the prices of its stocks and bonds over the last year as represented by actual sales on the exchange. This method gives the current *commercial* value and is even more exact than the valuation of a vacant building site by a comparison of the recent sale prices of adjoining lots; also, it saves the assessor the brain fag of assuming the items for depreciation and depletion or of calculating the cost of equipment or other factors. For the mineral property which is neither explored nor quoted on the exchange, which is of minor importance anyhow, there is no recourse but to proceed as described for valuing city lots, either by comparing recent sale prices or capitalizing potential net income.

Let us now turn to the assessment system for mines in vogue in Utah, to see if it bears any relation to the ordinary valuation methods for real estate.

As regards undeveloped mineral ground, its assess-

ment at the rate of \$5 per acre would be paralleled for vacant city lots, in Salt Lake City or Ogden, by valuing them at \$1.25 per acre just because that was the price that the first settler paid when he acquired title from the government. While the absurdity of such a system for urban lots would at once be seen in Utah, its application to mining ground apparently arouses no opposition, though it deliberately encourages that greatest obstacle to development that now plagues the United States—the holding of mineral land idle, by speculators for a higher price or by monopolists to prevent competition.

Though the Utah plan for assessing mines is more sensible, in that it results in a real instead of a negligible public revenue like the plan for idle ground, it is far from being consistent with the method used for urban real estate. For tangible surface improvements that can be measured, weighed and analyzed physically, such as structures, machinery, or equipment, the assessment of mining property is indeed similar to that used for other kinds of economic "capital," being based on the cost of reproduction less an estimated allowance for depreciation and obsolescence. But in its assessment of the value of underground "capital" and "land," the first consisting of shafts and tunnels and the latter of orebodies, which are often largely problematical both in size and quality, the Utah plan is like a ship far beyond sight of the shore and with no compass to guide its course.

At first sight this Utah plan seems to follow the scheme used for urban real estate in that it gets the value by capitalizing the "net proceeds," but a closer scrutiny shows this resemblance to be illusory. Without quibbling about the prescription for figuring net proceeds, which seems a good one, the use of a multiple of three for their capitalization means a percentage of 33 $\frac{1}{3}$ instead of the 6 used for urban real estate. The first discrepancy here introduced is the arbitrary assumption that a mine must yield 33 $\frac{1}{3}$ per cent annually on its capital investment to cover this proper interest and amortization charges. This assumption would be correct for a few mines, which last only four or five years, but erroneous for all others. The second discrepancy, even worse than the first from the standpoint of consistency, arises from the fact that as the capitalization of net proceeds should give the value of the whole property (both surface and underground) the further addition to this value of a sum to represent the surface improvements is an error equivalent to a partial duplication of the assessment.

The various inequalities in the practical working of the Utah plan, remarked by Mr. Young, proceed directly from these two serious deviations from the correct method of valuation. Inequities result both from the comparison of mining with other real property and from the comparison of one mine with another. As compared with urban real estate some mines with rich ore and few surface structures are favored, while other mines with lean ore and complicated mills are mulcted. The only mine on a par with real estate would be the ideal one the value of whose surface improvements plus thrice its net proceeds was equal to the commercial value of the property. If we compare one mine with another, we have the same unfair results; mines with bonanza smelting ores are under-assessed while lean mines with attached mills are the opposite: the large orebodies pay too little and the little ones pay too much.

I have said enough, I hope, to demonstrate that Mr. Young when he states: "Valuation of mineral in the

ground or valuation of a mineral property on the basis of ore developed and ready for mining is therefore too speculative for mining purposes," is out of accord not only with the long-used methods of real-estate valuation but with authorities like J. R. Finlay, who have successfully applied these methods directly to mining property. When Mr. Young finds that: "Mine owners are opposed to any system which attempts to value the ore in the ground" I should be interested in ascertaining to what "mine owners" he refers. Naturally the owners of bonanza orebodies don't want them valued for taxation purposes, if they can avoid it, but why should the owners of lean mines object? If the former class can thus shirk their proportional share of property taxation, must not the latter class pay more than they should? Unless perhaps both classes can unite to fool other property owners as to the true valuation of mineral property and throw a part of the correct mining burden onto city or farming estates. However, nobody could decide on the probability of the last supposition—the mining law being such an inconsistent hodgepodge—without a detailed study in Utah of the relative accuracy of actual assessments of the different kinds of real property.

Of course, all this doesn't mean that I disagree with Mr. Young in his depreciation of the assessment of mining machinery and buildings, but merely that I don't believe in robbing Peter to pay Paul. As long as a state assesses the whole value of other classes of property, why shouldn't it do so for mines? Until Utah mine owners begin to advocate the Philadelphia plan of exempting machinery or the Pittsburgh plan of exempting buildings from assessment, they have no case when they plead against the taxation of their hoists, bins or mills.

Mexico City.

ROBERT BRUCE BRINSMADE.

Andalusite in California

THE EDITOR:

Sir—I have read the article and letters in *Engineering and Mining Journal-Press* in regard to the discovery of the andalusite deposits of the White Mountains of California with a good deal of amusement. The original discovery of this deposit was somewhere in the '60s, during the boom of the neighboring silver camps of Benton and Indian Queen. The blue of the lazulite was so similar to that of the rich silver bromide ores of the latter that the prospectors had hard work believing it did not contain valuable metals. Each succeeding flurry in silver mining brought in a new crop of prospectors, who took a try at it, and McIver was only one of many.

My first contact with the deposit was about 1905, some ten years before Mr. Knopf noted it. At that time samples were brought me for determination and report. A qualitative analysis easily placed the minerals and an examination of the literature showed that there were then no known commercial uses. I still have specimens given me at that time.

The credit should be given for the discovery of a commercial use of a mineral previously only considered to be a museum curiosity and not for the discovery of a deposit which had been well known locally for many years. If the prospectors know what minerals can be turned into coin they can be trusted to find them, but they have no way of working out new uses for the otherwise valueless minerals and so making them of value.

A. M. STRONG.

Los Angeles, Calif.

Consultation

Effect of New Diamond Discoveries

"What effect will the discovery of new diamond fields in South Africa have upon the world's diamond market?"

The answer to this question depends upon the skill exercised by the interests that control the market and of course on the possible increase in output from sources other than South Africa.

The world today is absorbing diamonds to the value of about £12,000,000 annually, according to *The Mining and Industrial Magazine*. The principal sources of production have by mutual arrangement kept down the supply to suit the demand. That is a great achievement, resulting in a stabilized market and higher prices. According to official figures the current demand can be met by the Union of South Africa and the South-West Protectorate jointly producing about £8,500,000 yearly; the Congo Free State (Kasai fields) and Angola £2,000,000; British Guiana £1,000,000, and other sources, such as Brazil, Venezuela, Gold Coast and Borneo £500,000. Outside the Union practically the entire output consists of alluvial stones. These, though of much smaller average size than South African gems, are of high quality, and on that account mainly have been able to find their way into the world's markets. The greatest output of alluvial diamonds, however, comes from the Union of South Africa.

With regard to Tanganyika diamonds it should be pointed out that diamond mines rarely occur singly. They are generally in groups; this discovery might therefore lead to others in the same region. But it does not follow that the next one will be a payable mine. The Pretoria district has produced about a dozen occurrences to date, but the only payable one found so far is the Premier.

The discovery of any new alluvial field or kimberlite pipe of big dimensions is a serious matter, and calls for the exercise of considerable financial ability and tact to prevent a disturbance of the equilibrium on which the success of the industry as a whole vitally depends.

Twenty-five years ago the position was entirely different. The De Beers company held complete control and could carry on its broad shoulders the irksome burden that successive discoveries brought in their train. That day has gone; the Kimberley Corporation, powerful though it still be, no longer controls the market in its entirety; and foreign competitors must be met and dealt with on give-and-take principles. The output of each and every new field outside the Union of South Africa means a proportionate loss to the diamond industry of that country; the stability of the market is not merely of South African import but a matter of international concern, with British interests predominating.

Who Buys Barite?

I have a deposit of barite in Colorado which analyzes 89 per cent barium sulphate, 9 per cent silica, and 2 per cent calcium carbonate. Is there a market for such material, and if so who are purchasers?

It is questionable whether the material which you have would find a ready market in the industrial centers, by reason of the excessive freight which would have to be paid from Colorado to the Eastern cities. From the analysis which you have given the material would necessarily have to undergo some treatment to eliminate silica and calcium carbonate. As you are aware, much of this material is cleaned and concentrated, then ground and finally floated in order to get the best and softest material for use in the paint industry. The price of crude barite at the mines in the Carolinas, Missouri, Tennessee, and Georgia is \$7 to \$8 per ton. Barite is mined in Canada analyzing 94 to 96 per cent barium sulphate, which is quoted at \$9 per ton at the mine. The following is a list of a few companies that buy and use barium sulphate.

Barium Products Corporation, Carbondale, Ill.
Chicago Copper & Chemical Co., Chicago, Ill.
Midland Chemical Co., Chicago, Ill.
National Pigments & Chemical Co., St. Louis, Mo.
New Jersey Zinc Co., New York, N. Y.
Point Milling & Manufacturing Co., Mineral Point, Mo.
Sherwin-Williams Co., Cleveland, Ohio.

Ground Mica in the Industries

Can you furnish us a list of industries using ground mica, together with specifications?

Finely ground mica is used for decoration, chiefly in wall paper, fancy paint, ornamental tile, and concrete facing; as a lubricant, in annealing steel, and as an absorbent for nitroglycerine. Its heat-resisting qualities render it useful in railroad-car axle packings, in pipe and boiler coverings, in fireproof paints, and in rubber tires. Nearly all the mica ground in the United States is obtained from the mining and manufacturing of sheet mica, being the waste obtained from mining and the waste and trimmings resulting from the cutting of the sheet mica.

Coarsely ground mica is used in patent roofing compositions, and for this purpose biotite, or black mica, is also suitable. The mica serves the purpose of keeping the roofing material from chipping when rolling for shipping or storage.

The following table shows the percentage of ground mica used in various industries:

Patent roofing, (coarsely ground).....	60
Wall paper (finely ground).....	21
Automobile tires	8
Fancy paints	3
Molded electric installation	3
Annealing	3
Lubrication	2

Except in the case of material used in roofing, the ground mica should not contain any foreign substance, especially quartz, feldspar, or other gritty material.

The U. S. Bureau of Mines at its experimental station at New Brunswick, N. J., has done some research work in connection with the uses of mica in its various forms.

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

REPORT on Alaska Railroad by Secretary of Interior shows operating deficit; consolidation of Alaskan matters in one federal department urged; mining active in Fairbanks district; ore shipments from Hyder.

Mexican Government recalls permits for importation of explosives; Pedrazzini Mining Co. discovers rich silver ore; ambitious road-building program.

Another gold-copper discovery in Quebec; Dome and Vipond mines increase ore reserves; Lake Shore and Teck-Hughes prosperous.

British Columbia Silver Mines find extension of Premier ore zone, near center of property.

Lead-silver mines of Chloride district, Ariz., increase production; ore discovery at Bisbee, Ariz., may extend field indefinitely; American Copper Co. to develop 480 acres near Jerome.

Boulder Grubstake Association completes first year's program; gratifying results obtained.

Injunction filed to prevent merger of Denn-Arizona and Shattuck-Arizona companies.

Canadian Asbestos merger to be considered at stockholders' meeting Dec. 18.

Shortage of native labor on the Rand.—Prospecting for platinum continues unabated in South Africa.

Arizona Lead-Silver Mines Active —New Orebodies Found—Mills and Other Improvements Planned

Production of ore is increasing in several Arizona lead-silver districts, and a number of attempts are being made to develop new mines. The sampling plant at Kingman recently received sixteen cars of ore in one week from the Chloride district. Most of this ore came from the Elkhart, Altata, Silver Hill, Keystone, Juno, Towne, and Pinkham mines and is the record week's production for recent years. A loading bin is now being constructed at the railroad terminal in Chloride to reduce handling of the ore shipments at the loading point.

At Tombstone a new venture in the milling process for that section is the installation of a 50-ton Forrester-Rexman rod mill which will be used in grinding the ore from the Emerald dump. It is expected that rod mills will be utilized for the grinding of other dumps in the district if the Emerald installation proves a success.

The Gold Slope mining company has improved the road from the mine to Wilcox, and is sending its ore by truck to the railroad. Fuel-oil motors are used to supply power for the mine and mill machinery. Twenty-five men are employed at Wilcox and the same number at the McKittrick property, near Gleeson, which is shipping twelve cars of lead-silver ore per month to the El Paso smelter. E. A. Royce, owner of the Swastika mine, at Olive Camp, has raised funds to reopen the property, which was a heavy producer in the early days.

Salome, Ariz., became the center of a small mining boom when Charles Moore,

a Utah prospector, recently sunk a shaft on a small lead-silver stringer that outcropped south of the old Golden Eagle shaft of the Harqua Hala property. The stringer widened steadily with depth, and at 60 ft. had 4 ft. of almost solid cerussite. A number of prospectors have been attracted to Salome by the news of the strike.

It is reported that the McNeal mine, 14 miles south of Aguila, has been shipping high-grade lead-silver ore to the smelter. The ore occurs in rhyolite and andesite and appears to refute the common opinion that lead is not found in the eruptives in commercial amounts.

The Hilltop Metal Mines Co. has improved the road from its property to Rodeo and is making daily shipments to the railroad by truck. About fifty men are employed at the mine.

Injunction Filed to Prevent Consolidation of Denn-Arizona and Shattuck-Arizona Companies

Suit to prevent consolidation of the Shattuck-Arizona and the Denn-Arizona copper companies, Minnesota corporations, through an exchange of stock of the recently incorporated Shattuck-Denn Mining Corporation, of Delaware, was brought in St. Paul, Minn., on Nov. 17. The proposed consolidation is opposed, according to the complaint, on the grounds that the Shattuck-Arizona is a solvent, going concern with more than \$7,600,000 in assets and less than \$50,000 in current liabilities, while Denn-Arizona is insolvent. The plaintiffs declare that the proposed consolidation would benefit Denn-Arizona, but would be detrimental to present stockholders of Shattuck-Arizona.

Mills Operating in Joplin-Miami District 170—Many Additional Plants Under Construction

For a few days, recently, there were 170 mills operating in the Joplin-Miami district, which is the highest number ever recorded operating at one time. Temporary shutdowns reduced the number again, but several new mills under construction to be placed in operation before the end of the year, indicate that a new record will be established unless ore prices drop decidedly. The following companies have completed recently, or have under construction additional milling facilities:

Hugh Poyner and associates, a new mill in the Smithfield, Kan., section, near Crestline—the lease was drilled by Butler Brothers and preliminary development has justified the construction of the mill; Federal Smelting & Refining Co., a mill on its recently acquired lease at Granby, Mo.; Tri-State Mining Co. in the Oklahoma section; American Mining & Prospecting Co. in the Quapaw section of the Oklahoma field; Patty C. Lead & Zinc Co., a new mill just east of the Mary Jane mine, in Okla.; Mathiessen & Hegeler Zinc Co., a new mill on the old Napoleon lease, north of Joplin, Mo.; Beck Mining Co., a new mill on its lease of the St. Louis Smelting & Refining Co.'s land near Hockerville, Okla.; Underwriters' Land Co., a large mill on the Stebbins land, in the northwestern portion of the field, in Kansas; and besides these, a number of other companies are planning mill construction on leases drilled in recent months.

Shipments of concentrate are large, and should increase early in the new year, as new mills are completed.

Revival of Mining in Park County, Colo.

A marked revival in mining in Park County, Colo., is evident, as much eastern money is being advanced to reopen old producers, and open up some of the virgin territory.

Among the new discoveries of importance is that of the London Gold Mines Co. C. P. Aicher, manager, has found and opened the continuation of the main London vein in the Extension tunnel, several hundred feet south and 500 ft. lower than the lowest workings of the South London level. The North London mine and mill are being operated by a leasing company.

The Mount Bross Ores Co. has a force of men employed in the construction of a new cyanide mill in Buckskin Gulch, to treat the ores from the Paris-Excelsior properties.

Lessees on the Orphan Boy property, situated on Orphan Boy hill north of Mosquito Gulch, recently opened a 16-in. streak of sulphide ore containing values in gold, silver, lead, and zinc.

A discovery on North Star Mountain, called the Jaunita-May, promises to make good. The vein is about two feet wide and has been opened for about three hundred feet in length. The ore contains gold and silver.

A number of smaller places are being exploited, new buildings erected, and electric power is being installed, and some of these properties will doubtless be among the producers in the near future.

Minnesota Royalty Owners Appeal Mine Taxation Case

The Minnesota mine royalty tax law, passed by the Legislature in 1923, imposes a tax of 6 per cent on mine royalties. In a test case a year ago the District Federal Court ruled the law constitutional. The royalty tax payers have appealed to the court of last resort and the case will come up at Washington on Dec. 7.

The validity of the law is attacked on the grounds that it is a violation of the Constitution of the United States in that it takes property without due process of law, and also violates the inequality clause of the Constitution of Minnesota. Legal talent from Duluth will be assisted by Charles G. Hughes, of Michigan, John G. Milburn, and Nathan L. Miller, of New York.

The WAD Syndicate to Erect Mill on Kitchener Property

The WAD Syndicate, operating in the Long Lake district of Manitoba, has decided on the erection of a mill on the Kitchener property of the Central Manitoba Mining Co. H. A. Wentworth and Howard C. Davis, of the Syndicate, sailed for London Dec. 2, to confer with John Taylor & Sons as to plans for next season's operations, including the development of two other rich properties in close proximity to the Kitchener. Large quantities of supplies will be brought in over the winter roads.

Calumet & Arizona Mining Co. Ships 25 Tons of "Cement Copper" from Mine Water

THE Calumet & Arizona Mining Co., Warren, Ariz., has shipped to the Douglas smelter a carload of 25 tons of "cement copper" taken from the precipitation plant on the 1,500 level of the Junction mine. This is the first shipment of cement copper since the present precipitation plant was installed on Aug. 15, as an effective means of treating the water pumped from the 2,200 level. The process, thus far, has proved highly satisfactory in neutralizing the water and removing the acidity that is present in the water which is pumped from the lowest depths of the mines.

Anaconda-Harriman-Giesche Transaction Defended by German Press

In defense of the transaction whereby the holdings of the Giesche Erben have been taken over by the W. A. Harriman Co., of New York, and the Anaconda Copper Mining Co., of Montana, the *Deutsche Allgemeine Zeitung* points out that the Polish properties of the Giesche Erben were "at the mercy of the Polish anti-German policies and ruinous taxation," and that the company needed the backing of a powerful concern from a country much stronger than Germany, to prevent bankruptcy.

When the American companies examined the offer, however, the paper says, they found that the Polish properties alone would not pay sufficiently unless they could also get control of the company's zinc and ore supplies in Germany.

From a business standpoint, the *Allgemeine Zeitung* finds it reasonable that the Americans demanded inclusion of the German exploitation rights.

Anglo-Chilean Consolidated Nitrate Corporation Electrifies 25 Miles of Railroad

Construction work on the new plant of the Anglo-Chilean Consolidated Nitrate Corporation, in Chile, which is controlled by the Guggenheim Brothers, is progressing according to schedule. The company has just received final tenders from electrical manufacturers covering the electrification of 25 miles of the company's railroad. The contract will be let within two weeks.

Road to Quebec Gold Fields Completed

The new winter road from Angliers to Macamik, through the most exploited district of the new Quebec gold fields, has been completed. Last winter 500 men remained in the gold fields after the snow fell. Expectations are that nearly 3,000 prospectors and men engaged in drilling for some of the large mining concerns will find employment during the next six months.

Tennessee Charcoal Iron Co. Sold, Production to Be Resumed

The Tennessee Charcoal Iron Co., Collinwood, Wayne County, Tenn., has been sold to Louis E. Stoebig, of Chicago, for \$600,000. The property covers more than half of Wayne County, and extends into Hardin County. It is rich in timber land, and this will be utilized in the output of cordwood, hardwood, and some pine. The timber output is only a small part of the rich stores of the property, however, as there are also extensive deposits of iron ore. It is estimated that the daily output of charcoal iron will be 100 tons.

The plant is capable of producing 100,000 bricks daily, which will be taken advantage of in the new company's output.

With the purchase came several steam shovels used back in war days, as well as 100 or 150 dwelling houses, located on the grounds.

The new company will employ approximately 250 persons. In addition to these requirements, furnaces, locomotives, railroad properties, a power house, and other necessities came within the scope of the transaction. The property has been idle since the war. It is about 15 miles from Muscle Shoals.

Minnesota Occupation Tax Claimed Excessive

On Nov. 17 the Minnesota State Supreme Court took under advisement arguments in the case of ten mining companies against the State Tax Commission in which it is held that the occupation tax for 1924 was excessive. It is charged that the Tax Commission did not make sufficient deductions for mining, royalties, and development costs. The mining companies interested in the case are Bennett Mining Co., Biwabik Mining Co., Balkan Mining Co., Hoyt Mining Co., Mahoning Ore & Steel Co., Orwell Iron Co., Vermillion Mining Co., Crete Mining Co., Letonia Mining Co., and Interstate Iron Co. The tax assessed against these companies totaled \$453,045.83; the companies claim it should be only \$342,142.97.

British Lead Association Acquires German Chemical Works at Hamburg

The *Financial News*, London, Nov. 17, 1925, reports that the Associated Lead Manufacturers, Ltd., which controls in England important works at Newcastle-on-Tyne, London, and Liverpool, for the manufacture of white lead, lead oxides, and like materials, has recently acquired the Harburger Chemische Werke Schon & Co., A. G., whose works are situated in the neighborhood of Hamburg. The German plant will for the time being manufacture lead oxide only. It is being brought up to date, and its capacity considerably increased, as it is intended to supply not only the German market but also other northern European markets, for which the plant is splendidly situated.

The Alaska Railroad and Territorial Development

Operating Deficit, \$1,246,674; Payroll Reduced 17.6 per Cent—
Progress Hampered by Divided Authority—
Congressional Action Necessary

WITH reference to the scrapping of the Alaska Railroad the Secretary of the Department of the Interior stated in his annual report, just issued, that whether the railroad should ever have been built is now beside the question. We have it, and to abandon it despite the loss in its maintenance would amount to a reversion of the American policy of progress. This railroad was completed only in June of 1923. Its construction was hurried and some of its structures are flimsy and temporary in character, menaced by glacial rivers, and its tracks are underlaid by ice at some depth the year round, all of which makes the upkeep out of proportion to earnings.

When the construction of the Alaska Railroad was originally proposed the claim was made that with adequate transportation facilities mines in the interior of Alaska would be opened and flourish. In 1915, these minerals were valued at \$32,790,000. By 1924 they had decreased to \$17,457,000. Production of coal in Alaska in competition with the States has not been feasible. Neither has the cost of producing other minerals been sufficiently profitable to attract capital, although the government has provided the means of shipping them out.

Conversion of the right-of-way of this railroad to a truck highway; construction of a branch railroad from Portage Creek to Portage Bay; abandonment of the line from Anchorage to Seward entirely, or the use of that division only in summer, largely for tourists, have all been suggested. There is little local commercial use for a railroad between Anchorage and Seward, as both are seaports. It might be maintained in summer, it is suggested, as a pleasure road and the freight carried to Anchorage by water.

Automobiles require hard-surfaced roads. These could hardly be built in Alaska for less than \$50,000 a mile for surfacing and widening of railroad right-of-way. There are no such roads at present constructed in Alaska, and the effect of extremely cold weather on them is unknown. The alternate freezing and thawing of the surface in Alaska would be disastrous to truck roads, whether hard-surfaced or not. Gravel-surfaced roads are now impracticable in Alaska for heavy trucks except in periods when the roads are frozen.

Automobile traffic would encounter similar obstructions from slides in winter as do the railroads; their removal would be more expensive than similar clearings from the railroad right-of-way.

OPERATING LOSS SHOWN BY GENERAL MANAGER'S REPORT

The deficit of the Alaska Railroad for the fiscal year of 1925 amounted to \$1,246,674.52, a decrease of \$489,901.89

over the previous year, according to the annual report of the general manager submitted to the Secretary.

Total tons of commercial freight handled by the railroad in 1925 was 53,865, a loss of 5,667 tons, or 9.7 per cent, due to decreased shipments of ore. Rail freight revenues during the fiscal year amounted to \$412,194, representing a decrease of \$20,980 or 4.8 per cent. The total number of railroad passengers carried in 1925 was 48,300, a loss of 1,165, or 2.4 per cent.



Alaska Railroad Terminal, Anchorage, Alaska, at the head of Cook Inlet

The decline in the operating receipts, the report points out, was more than offset by reduced maintenance costs and in economies affected in the general expenses of the road. The total payroll in 1924 amounted to \$2,498,430.91. In 1925 it was \$2,051,026.75, a reduction of \$447,403.16, or 17.6 per cent. The average number of employees in 1924 was 1,056, compared with 981 in 1925.

The general manager in his report again called attention to the necessity of completing the railroad, the estimate of the cost being \$11,878,781. Expenditure of this amount over a period of years would provide such additional facilities and equipments as would be necessary for efficient and economical operation of the line. Decreased cost of operation and maintenance would also result, bringing a reduction in annual appropriations. The situation as it now exists with reference to maintenance and operation is one of economic waste due to the necessary hasty construction of the line. The work performed in repairing the line and putting it in condition after the frost has come out of the ground in the spring is not lasting, and the same work has to be again performed the following spring. This condition can be relieved only by placing the railroad in such physical condition that winter damage will be reduced.

The most important factors are the replacement of bridges supported on wooden piling with bridges supported on permanent masonry; the replacing of trestles, where necessary, with bridges or culverts and the filling of trestles not necessary; the placing of sufficient ballast under the ties to eliminate the damage to the track now suffered by frost heaves; the widening of cuts and fills to decrease the cost of necessary maintenance work incident to narrow cuts and fills and to decrease the expense of removing slides and replacing damaged fills, and the raising of the grade above normal high water to eliminate the constant temporary repairing due to floods.

Discussing the future of the Alaska Railroad, the report states that while no rapid development in the Territory can be looked for in the next few years.

there are indications of a gradual increase in traffic for the railroad, but there is no prospect that the operation of the railroad can be continued for some years to come without substantial appropriations being made to meet the deficit in operation incurred.

SELF-GOVERNMENT AN AID TO FUTURE DEVELOPMENT

Considering the future of the Territory, the Secretary called attention to the fact that Alaska is rapidly becoming a "lost province." "Without the inspiration of self-government," he continued, "or freedom of local initiative, opportunity for expansion has been curtailed by bureau officials made hesitant by limited authority.

"Alaskans have not been encouraged to develop pride of territorial growth or independence of administration. The maximum population of 75,000 whites has shrunken to 20,000 (estimated), and production from its natural resources wavers and recedes.

"Alaska's administration, divided as it is, among nine Federal departments and that of the Territory, is of the greatest menace to Alaska's development. Responsibility for the intimate obligations of her people to their Territory has been neglected by them and interfered with by the Federal Government.

"Inevitably, Alaska must compete in

the markets with its products. Climate, soil, and transportation are determining factors in agricultural competition and are necessarily weighed when development work of any sort is contemplated. Climate and soil conditions are fixed by nature. Transportation costs can only be eliminated by home production and consumption.

"The situation in Alaska calls for a prompt sympathetic study by Congress. Its natural resources and their possibilities; its methods of government and their effect; the attitude which we should assume toward it; whether governmental control should be constructive in type or continue to cultivate dependency, or be removed entirely, should be weighed by the legislative branch of government. The suggestion that all the government's activities in Alaska be merged into one department should have the immediate consideration of Congress."

Cantu and Riverside Mines Make Shipments of Ore from Hyder, Alaska

About twenty tons of float ore from the top of a vein on the Cantu property, on the Alaskan side of the international boundary at the head of the Salmon glacier, has been sacked and will be shipped from Hyder as soon as there is sufficient snow to allow of sledding. The ore is galena and gray copper, and from assays that have been made it is expected that the consignment will average \$150 per ton. The deposit was discovered late in the fall, and, as yet, the size of the lode has not been determined.

J. Littlepage, the former manager, and M. J. Sinclair have taken a lease and option of the Riverside mine, situated in the Salmon River valley, about 10 miles from Hyder, and have made a shipment of fifteen tons of concentrate. The property had been idle for several months.

Fairbanks District, Alaska, Enjoyed Busy Season

Fairbanks is now the center of more new mining activity than any other part of Alaska, owing chiefly to the development program of the Fairbanks Exploration Co., a subsidiary of the U. S. Smelting, Refining & Mining Co. During the summer this company employed about 400 men to advance an extensive gold-dredging project in the Fairbanks district. Four drills are now at work on Ester Creek, testing additional areas under option.

During the summer the company completed a 12-mile ditch to divert water from Chatinika River to lower Cleary Creek, where it will be used to groundsluice the overburden of the gold-bearing gravels. Cleary Creek has been the most productive creek in the Fairbanks district and will be the site of the early mining operations of this company.

An office building of concrete-block construction, a sawmill, garage, and other headquarters buildings have been erected at Fairbanks, and plans are now under preparation for the installa-

Alaska's Progress Menaced by Division of Authority

THE Secretary of the Interior in his annual report, says: "Alaska's administration, divided as it is among nine Federal departments and that of the Territory, is of the greatest menace to Alaska's development. Responsibility for the intimate obligations of her people to their Territory has been neglected by them and interfered with by the Federal government. The suggestion that all the government's activities in Alaska be merged into one department should have the immediate consideration of Congress."

tion of a power plant to supply electric power for dredging operations. Norman C. Stines is in charge of Alaska operations, Crosby Keen is resident manager, and D. C. Byer assistant manager.

The Fairbanks Gold Dredging Co. operated two boats on Fairbanks Creek, and the Chatham Dredging Co. operated a flume dredge on upper Cleary Creek at the mouth of Chatham Creek, these being the only dredges operated in the district during the summer. The Tanana Valley Gold Dredging Co. has launched a 4-cu. ft. Yuba dredge on Fish Creek and expects to begin work early next season.

There are three quartz mines producing at present in the district, and a dozen small properties are under development. The quartz mines in order of their production are the Mohawk mine, the Cleary Hill Alaska Gold Mining Co., and Crites & Feldman.

Boulder Grubstake Association Completes First Year's Program

Five Promising Ore Deposits Discovered at a Cost of \$1,700—Work Supervised by the Association

Community grubstaking of prospectors to revive mining interest in a former flourishing region has met with success during its first year in Boulder County, Colo., and will be resumed next spring on an increased scale. Three locations on virgin ground and two leases on patented claims are the immediate results of the movement thus far. Indirect results include a renewal of activity in regional mining camps that shows more properties being worked and more ore coming from the ground than at any time since the war.

From four to eight prospectors were kept in the field during the six months' period between May 1 and Oct. 30. These were paid at the rate of \$2 a day, this sum being approximately half the daily wage for miners. In addition, prospectors were given powder and other necessary materials for carrying on their quest for new lodes. Each grubstake miner also participates in proceeds from claims located. The total amount disbursed in this manner during the first season was \$1,700.

Results of the plan were made public at a "pork and beans" dinner in Nov-

ember, attended by more than 100 mining men and business men of Boulder. Announcement was made that several of the claims warranted development and further subscriptions were asked for financing work of that sort during the winter. Approximately \$600 was pledged. A contract has been let to sink a small shaft on one of the prospects. This claim is in the Magnolia district, a region which has been a big gold producer.

The organization operates under the name of the Boulder Grubstake Association. It was formed at the instance of P. C. Johnson, a Boulder business man who formerly was engaged in mining in the Central City district. Administration of the plan is in the hands of an executive committee of nine, four of whom are officers of the association. This committee started its work by interviewing the business men and individuals of the city and asking them to pledge a monthly sum for six months to finance the plan. One hundred and thirty responses were secured, the subscriptions ranging from \$1 to \$15 a month.

All prospectors approved for grubstakes had to satisfy the executive committee of their ability and their sincerity of purpose. Each signed a standard contract and made periodical reports on his activities. Members of the executive committee visited these men on the ground from time to time. Where a prospector was found to be wasting his time or applying it to development of privately owned claims, he was dropped from the list. In only one instance was this action necessary.

Under the terms of the agreement, all claims which show promise are recorded in the name of a trustee, a Boulder business man having been designated for this place. Ownership of such claims is thus held in trust, 75 per cent of any returns going to the prospector and 25 per cent to the association. Income of the association will go into the treasury for additional grubstaking and for development of promising claims. Two small shipments of pay ore have thus far been made, while a considerable tonnage of ore has accumulated at remote points.

No one connected with the association receives remuneration. Engineering work necessitated by location of claims has been donated by mining engineers of the city. The plan has been even more successful than was anticipated for its first season, and it is assured that it will be continued next summer, with all indications pointing toward an enlarged scale of operations.

A report will be made at the annual meeting of the Colorado Mining Association and an effort made by Boulder mining men to secure the support of the state organization for a state-wide movement operating in a similar way.

At various times subsidies for mining exploitation have been created in Colorado without tangible results. This was because there was no provision for personal contact and direct supervision of those sent into the field. The association proposes that a committee similar to the one in Boulder County be formed in every mining county of the state.

Washington News

By Paul Wooton
Special Correspondent

Bureau of Mines Functioning Under Reorganization

Official announcement of the reorganization of the U. S. Bureau of Mines puts into effect most of the tentative plans which already have been reviewed in this correspondence. The outstanding feature is the creation of a new major branch of the Bureau which will be devoted to the economic problems of mining.

There will be no interference with the technologic work which the Bureau long has conducted with great success. In the reorganization this work is concentrated under the immediate direction of Dorsey A. Lyon. This will involve no great change in his duties, since as assistant director of the Bureau, and through his assignments as chief metallurgist and supervisor of stations, he has been directing this work for several years.

The new economic branch gives every promise, observers in Washington think, of being able to supply the mining industry a business and industrial service which is essential to its maximum progress. The opinion is ventured that no single act of Secretary Hoover in his effort to furnish industry the assistance it desires will be productive of such far-reaching results or so likely to be a permanent monument to his organizing ability.

The reorganization carries out the fundamental principle of centralizing the economic studies of the government which deal with mining and so interlaces them with technical studies on the same subject as to bring to bear on the problems of mining the joint economic and engineering resources of the department.

With Mr. Hoover as secretary; with a mining engineer of much experience in the school of real life at the mines as director of the Bureau, and with a chief of the economic branch as broad gaged and as familiar with the business as is C. P. White, the new branch is starting under promising auspices.

In this connection, Mr. Hoover points out that nothing is being added to the government service. The new branch simply is the grouping of the minerals-resources activities formerly conducted by the Geological Survey; some of the minerals activities of the Bureau of Foreign and Domestic Commerce; some of the statistical services which have been handled in the Bureau of the Census, and some of the work scattered through the Bureau of Mines. Duplication is being weeded out and the whole service strengthened, Mr. Hoover is convinced.

There is every reason to believe that the details of the internal organization, which will be worked out by Mr. White and his associates, will take full advantage of the unique opportunity afforded to build a base broad enough to carry such additions to the superstructure as are certain to be made from time to time.

Many think there is need for market

information covering the mineral commodities and the expansion of statistics in co-operation with trade associations. One of the important activities of the branch is certain to be its service as a clearing house for information as to the business aspects of mining.

One idea which pervades the reorganization is that no service shall be imposed upon the industry. Every step that has been taken or is in contemplation has been approved by the advisory committee which is representative of the industries most concerned with the work of the Bureau.

Case of Copper Giant Vs. Clarinda Copper Closed in Favor of Defendant

A verdict in the case of the Copper Giant Mining Co. vs. the Clarinda Copper Mining Co., Clarksfork, Idaho, alleging trespass and the diversion of water, was rendered in favor of the defendant Clarinda company in the Federal Court on Nov. 24. A corps of engineers and experts testified, including Dean Thompson, L. K. Armstrong, George R. Trask, Otto Weile, and M. Potter for the Copper Giant and Rush White, F. A. Calloway, and Caryl Wilson for the Clarinda company. This verdict clears the way for development work on the Clarinda, which has been held in abeyance pending settlement of litigation.

British Columbia Silver Mines Make Valuable Ore Discovery

After two and a half years of steady exploration by tunneling, drifting, crosscutting, and diamond drilling on the northern extension of the Premier Gold Mining Co.'s ore zone, in the Portland Canal division of British Columbia, the British Columbia Silver Mines has located and is opening up an important body of ore. The existence of an ore zone, 250 ft. long and carrying gold and silver, in the center of the company's property, has been demonstrated by diamond drilling. A drift has been driven on this ore shoot on No. 3 level for 80 ft., with the face of the drift still in good ore. The average value of the ore taken out in drifting is around \$30 per ton.

American Copper Co. to Develop 480 Acres Near Jerome

Development of the property of the American Copper Co., consisting of 480 acres, 10 miles south of Jerome, Ariz., is to be undertaken by Thomas Thorkildsen, who is also interested in the operation of a borax property. The Southern Jerome group covers for nearly three miles a mineralized contact area which lies on the south-westerly slope of the mountain range of which Jerome occupies the north-easterly slope. Little deep work has yet been done, but surface trenching has uncovered mineralized areas from 50 to 300 ft. wide and from 600 to 1,500 ft. in length. The first work to be done by Mr. Thorkildsen will be diamond drilling under the direction of the Continental Diamond Drilling Co.

Porcupine Goldfields Leases Goodenough Claims, Near Ymir, B. C.

Porcupine Goldfields Mining & Finance Co. has taken a lease and option on the Goodenough claims, three miles from Ymir, B. C., and has started a 250 ft. tunnel to open the orebody at 150 ft. below the old workings. About a mile of road is being graded to connect the property with the main Ymir highway. As soon as the last work is finished, a compressor and engine will be taken in. Considerable work has been done on the property, from time to time, with the object of picking up the extension of the Ymir vein, which was worked profitably for many years, and, though this does not appear to have been achieved, some good ore has been found at several points by shafts and tunnels.

Victoria Mine Sells Supplies to Pay Taxes

The Victoria mine, in the Michigan copper district, which has been closed for several years, has decided to sell its mine supplies to provide money for taxes and incidental expense. It is offering for sale a stock of drill steel, T rails, light tools, powder, fuses and other materials. Victoria taxes are approximately \$4,000 per year. The company also owns a small sawmill and an effort will be made to sell this equipment. It also has electric pumps and motors for sale. This does not mean that the property is to be abandoned as has been rumored in some quarters. The shafts and equipment, water power and surface plants are intact.

Miners Return to Michigan Copper Mines

With the improvement of conditions in the copper industry, a number of former residents of the Michigan copper district are returning to take positions with copper companies. The employment department of Calumet & Hecla is making a weekly report of former employees who are returning, and the list, while not large, is encouraging. Men are coming back from the industrial centers of Michigan, Minnesota and Wisconsin.

Cuba Adopts U. S. Specifications for Granite Paving Blocks

A report received Nov. 24 from R. M. Connell, U. S. Trade Commissioner at Havana, states that the Cuban Secretary of Public Works has adopted the United States standards for paving blocks. Bids will be called for in December for about 40,000,000 blocks, 8,000,000 to be used on roads in and about Havana and 32,000,000 for roads in Havana Province. The government has not yet formulated the advertisements, but it is understood that sixty days' notice will be given from the date of the first publication of the call. Notices will be published in the United States as well as in Cuba.

London Letter

By W. A. Doman
Special Correspondent

Consolidated Gold Fields Acquires Zinc-Lead Mine in Italy

London, Nov. 17.—The Consolidated Gold Fields of South Africa owns the whole of the share capital of the New Consolidated Gold Fields, so that the operations of the latter really refer to the former. An interesting item in the annual report is that Malcolm Maclaren has accepted the position of consulting geologist to the company. Dr. Maclaren has done important work in various parts of the world, and in securing his services the Gold Fields has considerably strengthened its position. The Gold Fields has acquired an interest in a zinc and lead property in northern Italy, which is operating profitably. The mine has recently been visited by Dr. Maclaren, and its prospects are considered to be most promising. The Gold Fields is operating the Mill Close lead mine, in Derbyshire, and reports that there has been a considerable increase in the quantity of lead won from the mine during the last twelve months, the proceeds of which, at the higher market prices which have ruled, enabling the company to free itself of all liabilities and to earn substantial profits. Developments continue favorable, and it is anticipated that the dividend stage will be reached during the current year. An adjoining property has been taken up by a London syndicate, and it is expected that work will begin soon. This particular area was mined a century or so ago, but is now under water. A tunnel about two miles long was driven toward it, but as the owner struck the Mill Close veins first, he did not proceed further. The intention now is to continue this tunnel to strike the continuation of the veins. The mining laws of Derbyshire are complicated, and extralateral rights are in force.

The Gold Fields is largely interested in platinum in South Africa and not only is a holder of shares in different companies, but as regards some it has undertaken the technical management.

Comstock Merger Mines have so far proved disappointing.

Cam & Motor (Rhodesia) annual report was regarded in the market rather unfavorably, dividends being only 5s. as against 5s. 6d. per share, while the sum carried forward was reduced from £13,297 to £3,866. An examination of the report seems to indicate that a better showing could have been made, for the ore milled was well below that of the ore reserves. A year ago the reserves were 834,000 tons, averaging 55.2s. per ton. The reserves are now at 936,000 tons, averaging only 50.1s. per ton. Since the date of the report—June 30—exceptionally high-grade ore has been found, and an improved exhibit could be made during the present year if thought advisable.

The Burma Ruby Mine, brought out under the auspices of Messrs. Rothschild in 1889, has at last gone under. Rothschild's name being so seldom on

a prospectus created a sensation at the time, and extraordinary scenes were witnessed at New Court (the bank's offices) when prospectuses were available and the lists were opened. There has been nothing comparable with it since. Of late years returns have diminished, and as satisfactory arrangements could not be made with the Secretary of State for India as to leasing, the directors have decided to liquidate the property.

On previous occasions I have mentioned the Lena Goldfields and the negotiations between the directors and the Soviet authorities at Moscow. The concession provisionally concluded in April last was signed in Moscow on Nov. 15, and it is stated by a news agency that the conceded enterprises have already been delivered to the concessionaires. No official statement has yet been made by the company, and the city is wondering what the exact terms are and how much capital will have to be raised.

Mexico City Letter

By W. L. Vail
Special Correspondent

Permits for Importing Explosives Annulled—Extensive Road-Building Program in Effect

Mexico City, Nov. 27.—The Mexican Secretary of War and Navy has issued a circular annulling all permits for bringing explosives into the country, effective Dec. 31. After that date applications must be made in each and every individual case where it is desired to bring explosives into Mexico, setting forth the place from which the article is shipped, the customs house on the Mexican frontier through which it is to be introduced, the quantity of explosive, to whom shipped, and the specific purpose for which it is to be used. Mining companies may not resell or otherwise dispose of any explosive imported without a special permit from the commander of the nearest garrison and must render each month a detailed statement of the amount of explosives employed and how. All applications for permits to bring in or transport explosives must be accompanied by receipts showing that all income taxes have been paid and other taxes current for the properties concerned. The object of the latest order is to prevent explosives falling into the hands of possible roving bands.

The Pedrazzini Mining Co. (Paris), has announced the recent discovery of a vein assaying 100 oz. of silver to the ton. The property gives evidences of having been extensively worked by the Aztecs prior to the Spanish conquest. The same report estimates the profits of the Pedrazzini properties for the current year at something over 5,000,000 francs, or 25 per cent on the capital stock of the company. At the last stockholders' meeting, an increase of capital stock from 22,000,000 francs to 35,000,000 francs was authorized. The purpose of the increase in stock is to take over the *Compañia Minera*

Santiago y Anexas, in which the Pedrazzini people have already an interest to the amount of 10,000,000 francs.

A patent process owned by California parties is being tried on tailings in Pachuca whereby great results are promised from the action of steam and hydrogen. Operations have not advanced to a point where satisfactory results can be assured.

Development work on the big iron deposits known as Las Truchas, near the Balsas River in Guerrero and Michoacan, has been practically suspended. This property was taken over some time ago by the Bethlehem Steel merger. More than half a million dollars has been expended on development to date. It is claimed that 60,000,000 tons of iron ore is in sight. A report is current that devotion to Bethlehem Steel's big leases in Chile is the cause for a temporary slowing down on the Mexican properties.

The State of Morelos, which is not much of a mining region, is showing some slight activity. The principal mine operating is the Tlalchichilpa, a famous old property, now controlled by French capital and managed by Mons. Jaques Gillet. This mine was worked extensively in colonial days, and the bullion was transported to Vera Cruz. For many years it was in the hands of Don Inigo Noriega, a well-known Spanish capitalist during the Diaz administration. It was upon the report of P. K. Lucke that the French syndicate concluded its purchase, together with a number of adjoining claims, something over a year ago.

CONTRACTS LET FOR 3,000 MILES OF AUTO ROADS

A contract between the Mexican Government and the Byrnes Brothers, of Chicago, for over 3,000 miles of auto roads is stimulating denouncement and development work on mines, particularly in the states of Morelos, Guerrero, Hidalgo, Puebla, and San Luis Potosi. The Byrnes Brothers are already at work on the sections from this city to Puebla, to Pachuca and Tampico, and to Acapulco, on the Pacific Coast. About 3,000 men are now employed in the various camps. The contract, which is undertaken on the basis of 10 per cent plus, requires a completed roadway from this city to Laredo, on the Rio Grande, within one year, and from this city to the Guatemala border through the states of Puebla, Oaxaca, and Chiapas within three years. Expenses of the work, which are about 1,000,000 pesos monthly, are met from a special gasoline tax recently imposed by the Mexican Government. An additional tobacco tax is being proposed for the purpose of continuing the good-road work on the west coast, giving an outlet to the Pacific for a large mineral region nearly 2,000 miles long.

INCREASED WAGES FOR MINERS

The new labor law which requires mining companies, among others, to dedicate 10 per cent of the profits to their employees, or, in lieu of that, a 10 per cent present on their wages for the year, and a two week vacation each year, is giving the managements something to think about.

Toronto Letter

By Our Special Correspondent for
Northern Ontario

A New Copper-Gold Discovery in Quebec—Dome and Vipond Also Find Additional Ore

Toronto, Nov. 27—A new copper-gold discovery is reported in Boischatel Township, in Quebec, within a few miles of the Ontario boundary. The find was made on claims owned by Alderson and McKay, consulting engineers of Montreal, who have been in charge of the Lake Fortune gold claims. Practically no information is as yet available, but it has resulted in a staking stampede. More information will be available in the course of a few days when some of these men return.

The question of the right of the Ontario Government to extend the Nipissing Central Railway into the Province of Quebec over crown lands owned by Quebec is now being heard before the Supreme Court of Canada. The Quebec Government claims that the Dominion has no authority to grant right-of-way over Quebec crown lands, while the Ontario Government claims that a precedent has been established in the case of the Transcontinental Railways.

The directors of the Dome Mines, of Porcupine, have issued a statement to the effect that a series of diamond-drill holes drilled from stations on the north side of the 14th level have found a new orebody. The ore has been reached by a drift, the first 130 ft. of which gave an average of \$8.86.

At the Vipond property, the No. 8 vein has been encountered at the 1,125 level and has been drifted on for 100 ft., but information regarding widths and values is not yet available. New additions and changes are being made at the mill, and it is expected that by next April the mill will be treating 300 tons a day.

The Lake Shore Mines, of Kirkland Lake, has declared a dividend of 5 per cent with an extra bonus of 5 per cent, payable Dec. 15 to shareholders of record Dec. 1. This will bring the total disbursements for 1925 to \$600,000, or 30 per cent. It is expected that dividends in 1925 will amount to at least 40 per cent.

The mill and shafthouse of the Kirkland Rand Mines, which were built when the property was known as the Ontario-Kirkland, have been destroyed by fire, the estimated loss being approximately \$200,000. This mill was operated for a short time only, as it was found that the grade of the ore was too low for profitable operations. Development, however, has been continued, and it was reported recently that ore of much better grade has been found.

The annual report of the Teck-Hughes Gold Mines for the year ended Aug. 31 shows a bullion production of \$925,000, a decrease of \$285,000 compared with the previous year. Total operating expenses were \$547,000, leaving net profits of \$378,000. Expenses were high on account of the large amount of construction and develop-

ment work done. A total of 48,718 tons of ore was treated, the recovery averaging \$18.08 per ton. During the year \$107,000 was spent on sinking, raising, and station cutting in the central shaft and \$153,000 for new mill construction. The company now has a cash surplus of \$1,000,000.

At the Morrison property, in Gowganda, which is owned by the Tonopah Canadian Mines, Ltd., a total of 392 ft. of drifting was done in October, with one machine working two shifts. This remarkable footage has been exceeded in the province only by work done on the Walsh claim owned by the same company, where 410 ft. was driven in one month last summer.

Canadian Asbestos Merger to Be Considered at Stockholders' Meeting Dec. 18

The long-contemplated merger of seven Canadian asbestos companies is apparently approaching consummation. A special meeting of the shareholders of Asbestos Corporation of Canada, Ltd., has been called for Dec. 18 to consider a new plan which is regarded as more advantageous than former propositions, the details of which are given in a letter to the shareholders.

ASBESTOS CORPORATION, LTD.

A new corporation has been incorporated under the title of Asbestos Corporation, Ltd., with an authorized capital of \$3,000,000 6 per cent first refunding mortgage 15-year bonds; \$10,000,000 6 per cent general-mortgage bonds; \$12,000,000 7 per cent non-cumulative and non-participating preferred shares of the par value of \$100 each; and 200,000 common shares of no par value. Of this authorized capital, there will remain unissued and available for development \$5,200,000 6 per cent general-mortgage bonds, and \$4,500,000 7 per cent preferred stock. The only public offering in connection with the merger will be the issue of \$1,300,000 6 per cent first-mortgage gold bonds.

Control of the corporation will be in the hands of a voting trust for the next five years, the voting trustees being J. W. McConnell, Frank P. Jones, and Arthur White. Preferred shareholders will receive for each \$100 of stock \$100 of 5 per cent general-mortgage bonds, \$20 par value of non-cumulative preferred, and one share of non-par common stock, the aggregate value of which is \$130. Holders of the present common stock will receive \$110 par value of new preferred and one share of new common.

COMPANIES INVOLVED IN THE CONSOLIDATION

The companies in the merger are: Asbestos Corporation of Canada, Consolidated Asbestos, Federal Asbestos, Thetford Vimy, Maple Leaf Asbestos Corporation, Asbestos Mines, and the Black Lake Asbestos & Chrome Co.

Figures published by the Dominion Bureau of Statistics show that Canadian mines in 1924 produced approximately 80 per cent of all asbestos mined in the world, the output increasing from 380 tons in 1880 to 225,744 tons in 1924.

Johannesburg Letter

By John Watson
Special Correspondent

Platinum Prospects Continue Promising—Shortage of Labor at Gold Mines

Johannesburg, Oct. 27—Prospecting work for platinum, recently carried out by the Transvaal Consolidated Land & Exploration Co., continues to show highly promising results. On the farm Der Brochen, owned jointly by the T. C. L. and the Transvaal and Delagoa Bay Investment Co., it has been proved that the whole length of the farm is traversed by a norite reef, which has now been fully exposed in seventy consecutive cuttings. In one section, representing a length along the outcrop of over 3,000 ft., the acreage value, as shown in these cuttings, is 3.5 dwt. per ton over an average width of 5 ft. The upper portion of the reef shows higher values and, in this series of trenches, the average value of the upper portion over 30-in. width is 4.7 dwt. per ton. The frequency with which values ranging from 5 to 9 dwt. occur in sectional samples is a very encouraging factor. On the farm Onverwacht, No. 1 winze, in dunite, has been deepened to the 200 level, the average value disclosed, from 150 ft. to 200 ft. down, being 21.8 dwt. per ton. Exploratory work on the 200 level, by means of crosscuts driven in various directions, is now being performed. Satisfactory progress is being made with the installation of the experimental reduction plant.

At the last meeting of the Chemical, Metallurgical and Mining Society, held in Johannesburg on Oct. 17, a gold medal was presented to Gunnar Bergstrom, for his paper on "Electrical Prospecting."

The gold mines are again feeling the shortage of native labor, owing to the restrictions imposed by the government on the employment of East Coast natives, and also because of the fact that the British South African natives have had good crops on their lands and are not offering their services to the mines. Since July, there has been a reduction in the number of Europeans employed on the Rand in consequence of the shortage of native labor. On thirteen mines, with underground requirements of over 50,000 natives, only 40,321 are employed.

A discovery of platinum is reported near Drummond, in the Inhang Valley, Natal, where a well-known prospector, W. H. Cross, has found platinum, assaying over 1 dwt. per ton, in reef formation. A wide area of claims has been registered in the name of the discoverer and his associates.

On the Johannesburg Stock Exchange, during the last week, there has been a large turnover; the chief feature has been the heavy liquidation in land and platinum shares. Gold shares have been easier, bonds and platinum have declined, and there has been considerable business in Tanganyika diamonds and Leenwpoort tins.

Societies, Addresses, and Reports

Mining Congress Annual Meeting Opens Dec. 9

Taxation, Value of Joint Selling Agencies as Protection to Public, and Industry and Labor on Program for Discussion

Members of the President's Cabinet, prominent government officials, members of Congress, a former Labor Minister of Canada and leading mining men from various parts of the United States are scheduled to discuss important questions affecting the production and distribution of mine products at the twenty-eighth annual convention of the American Mining Congress at the New Willard Hotel in Washington on Dec. 9, 10 and 11. James J. Davis, Secretary of Labor; Herbert Hoover, Secretary of Commerce; William E. Humphreys, Federal Trade Commissioner; Representatives Joe J. Manlove of Missouri and James Murdock, former Minister of Labor of Canada, will address the convention, which will consider a national labor policy, mine taxation, joint selling agencies in the distribution of mine products, and other important mining problems.

The convention will be opened on the morning of Dec. 9 by Louis S. Cates, of Salt Lake, vice-president of the Utah Copper Co., who will deliver his annual address as president of the Mining Congress. He will review the work of the organization in behalf of the development of the mining industry during the past year and outline a program of continued activity. A number of metal-mining and coal-mining operators will present a survey of the requirements of the mining industry in the various mining districts of the country.

TAXATION TO BE DISCUSSED

An afternoon session on Dec. 9 will be devoted to a discussion of federal and state taxation of mines. This will be the annual national mine tax conference, in charge of McKinley W. Krieger, of Washington, D. C., chairman of the organization's tax division, and Paul Armitage, of New York, chairman of the general tax committee.

In view of the present anthracite strike and the threat of the miners' union to call a bituminous strike, the proceedings of the convention on Dec. 10 promise to be of interest, as they will be devoted to a consideration of plans for the peaceful settlement of labor disputes under a broad national labor policy. "The Mining Industry and Labor" will be the topic upon which this subject will be discussed. The afternoon session will be devoted to group conferences, the largest of which will be that of the standardization division of the Mining Congress. This conference will be presided over by Col. Warren R. Roberts, of Chicago, chairman of the coal mining branch, who will report on the work done during the past year.

The annual banquet will be held on Dec. 10.

Quicksilver Research Completed at Berkeley Station

Bureau Advises Study of Mining Methods and of Geology of Deposits as Offering Greatest Chance for Economy in Production

A comprehensive study of the metallurgy of quicksilver has been completed by specialists of the U. S. Bureau of Mines attached to the Pacific Experiment Station, at Berkeley, Calif. In the seventy-five-year period ended with 1924, the United States produced 2,436,000 flasks (75 lb.) of quicksilver, worth \$121,191,000, state the investigators in a report recently published. California yielded the great bulk of this total; the remainder came from Texas, Oregon, Nevada, and Arizona. Most of this metal has been extracted from low-grade ores, those containing less than 0.5 per cent mercury, or 10 lb. per ton. The finished product, or "virgin metal," is made at the mine and shipped in flasks.

QUICKSILVER AN INDISPENSABLE METAL

Quicksilver is unique in being the only metal that is liquid at ordinary temperature. Because of this and other physical and chemical properties, it is one of the most indispensable metals to industry. On the other hand, the quicksilver industry of the world is of vanishing significance when compared with the major mineral industries with respect to quantity and value of product, capital invested, or the number of men employed. The peculiar value of quicksilver is due to the fact that in some of its applications no substitute is available and in others the substitutes would be unsatisfactory or extremely expensive. Scarcely a branch of science or industry fails to make some use of mercury or its compounds. As a detonator for explosives, mercury fulminate holds first place, and in safety and reliability could be replaced only by the highly expensive silver fulminate. Through its use in detonators and in the metallurgy of the precious metals quicksilver is of special importance to mining. In medicine, in the manufacture of electrical apparatus, the production of pigments and anti-fouling paints, and the general field of experimental science quicksilver is equally indispensable.

Because of its small commercial importance and the lack of a stable market and price for the metal, the quicksilver industry, as a whole, has not had the benefit of the same metallurgical and business direction that has been given to the winning of the major metals. The unique relation of mercury to national health because of its use in certain drugs and to national security because of the need for quicksilver fulminate for defensive purposes and the indispensability of the metal and its compounds in science and industry seemed to justify investigation of the quicksilver industry by the Bureau of Mines. In Europe, government interest has been direct. The rich deposits

at Almaden, Spain, are owned and the product is marketed by the Spanish Government; the mines at Idria, formerly belonging to the Austro-Hungarian Government, have now passed under Italian control; and the most productive mines of the Monte Amiata district, Italy, which were largely owned by German interests, were taken over by the Italian Government after Italy's entry into the World War. While under the control of the Austro-Hungarian government, the mines and reduction works at Idria employed a number of able engineers, and as a result, notable advances in the metallurgy of quicksilver were made there. In the United States the quicksilver deposits, which can supply domestic needs for many years to come, are, of course, privately owned.

The main conclusions to be drawn from the experimental work performed by the Bureau of Mines may be summarized as follows:

In the direct-furnace treatment of quicksilver ores the major problem in the extraction of quicksilver has been solved. Methods are available whereby low-grade ore can be treated with a remarkably high recovery and at low cost in view of the small scale of operations at most plants. It does not follow that present practice at all or even at the majority of the quicksilver reduction works in this country has reached the highest possible point of efficiency. Improvements can be made at many plants mainly by correcting minor defects rather than by making fundamental changes in the process used.

In the past the quicksilver industry has suffered from lack of competent technical supervision, and some time and effort have been wasted through attempts to devise improvements in process and equipment without adequate regard for developments in other branches of metallurgy. Knowledge of the metallurgy of quicksilver has advanced so far that adequate information is available for the design, construction, and operation of a plant for the treatment of any ordinary mercury-bearing ore. Improvements in practice will consist mainly in applying available information more efficiently.

CAN REDUCE MINING COST

Mining of the ore offers the greatest opportunity for reducing production costs. To bring the ore to the reduction works generally costs two or three times as much as to treat it. This expense is due partly to the mode of occurrence of quicksilver deposits, and partly to the fact that mining operations are seldom conducted with maximum efficiency. Fluctuations in the price of and demand for quicksilver have tended to prevent operators from carrying on development in advance of actual mining; in consequence, the planning of a systematic mining program has been impossible. As the outcome of activities during the World War, however, a number of properties now have fair quantities of ore definitely blocked out. The Bureau of Mines believes that the greatest opportunity for increasing the economy in quicksilver production lies in giving more atten-

tion to the geology of the deposits and the improvement of mining methods.

The results of this experimental work are contained in Bureau of Mines Bulletin 222, "The Metallurgy of Quicksilver," by L. H. Duschak and C. N. Schuette, which may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., at a price of 30c.

Tempering of Fishtail Bits Studied by Bureau

In July, 1924, the Bureau of Mines, through its Petroleum Experiment Station, undertook a field study of methods used in oil-field shops for dressing and tempering fishtail bits. The purpose of this work was to suggest changes that would be helpful to the bit-dresser in turning out better-treated, harder, and tougher bits, and thus cut down the excessive loss of time caused by too frequent changing of bits. It was the intention to eliminate as much as possible the guesswork connected with dressing and tempering bits under the method of judging temperatures by eye, by developing practical methods of controlling temperature. If there were some possible means of applying accurate temperature control, then it would be an easy matter to bring all bits to the proper temperature for maximum hardness and toughness, thus doing away with the source of most of the trouble experienced in the present method of bit tempering.

Every method of analyzing the figures obtained in this investigation shows that a proper method of heating and quenching fishtail bits will increase the footage obtained per bit by more than 50 per cent and reduce the drilling time per foot by a third of that obtained when bits are treated in an open fire without temperature control and quenched under conditions that vary. There does not appear to be any sound basis in the figures obtained in this research for saying that one composition is superior to another for fishtail bits. Report of Investigations No. 2712, which may be had from the Superintendent of Documents, Government Printing Office, Washington, D. C., describes the research in detail.

Taylor Society Discusses Management

The annual meeting of the Taylor Society was held in the Engineering Societies Building, 29 West 39th St., New York City, Dec. 2 to 5 inclusive. Among those on the program was William Green, president of the American Federation of Labor, who talked on "Labor's Ideals Concerning Management" on the evening of Dec. 3. On the afternoon of Dec. 4 a symposium on "The Relations of the General Manager and His Principal Executives" was held, in which several executives of prominent industrial enterprises took part. The annual dinner was held that evening at the Fraternity Club.

The Taylor Society, which is an international organization for the promotion of better management, is now in its fifteenth year.

Zaruma Gold District, Ecuador, Described by Billingsley

Fundamental Economic Geology Resembles That of Various Rocky Mountain Mining Regions—Portovelo a Modern Camp

Paul Billingsley, geologist for the International Smelting Co., discussed the geology of the Zaruma, Ecuador, gold district at the November meeting of the Utah Chapter of the American Institute of Mining and Metallurgical Engineers in Salt Lake City.

First attention of the white man was attracted to the Zaruma mines when Pizarro landed at Tumbez, whence the gold so plentiful in this place was traced to the Zaruma district near the southwestern corner of Ecuador, thirty-one miles from the coast.

"Mercadillo," said Mr. Billingsley, "one of the original band, reached Zaruma, having worked his way upstream through canyons that are now regarded as impassable. The Spaniards proved themselves efficient prospectors, finding practically every orebody in the district as yet discovered and working with impressed Indian labor they were able to mine ore of lower grade than can now be profitably extracted, even with modern equipment.

"The outcrops were first attacked by sluicing, water being led around the steep hillsides as far as necessary to reach the uppermost portions. Soil and decomposed vein matter were washed down to feed small stamp mills with stone shoes and mortars, and crushed material passed over riffles.

"When a vein could not longer be exploited in this manner, underground workings were driven and the ore was stopped. Although the steep hillsides afford room for many tunnel levels, the Spaniards apparently did not conceive the idea of utilizing a lower outlet for their ore. Their workings usually go down on an irregular incline until water level is reached, and the slopes and raises form an amazing labyrinth.

"During the early part of the nineteenth century mines became abandoned and in many cases the portals were completely hidden by the dense tropical vegetation. From this condition the district has been rescued by the energy of foreigners. Inaccessibility and tropical diseases multiplied the ordinary hazards. The first company, a British organization, gave up the attempt after much work and expenditure. Just as the success of the Panama Canal depended on medical and diplomatic talent no less than on engineering, so the profitable development of the Portovelo mines has necessitated the solving of many problems not normally inherent in the mining industry.

"Malaria has been almost eradicated by the widespread clearing of brush, draining and the use of screens; dysentery and typhoid, by care in the use of drinking water and by the introduction of sewage systems. The white employees have comfortable homes and all the recreations of a normal American community. The living conditions of the native employees have been vastly improved. At the end of two days' mule ride over the jungle trail,

the sight of the pleasant modern camp of Portovelo fills the visitor with amazement.

"Superficial conditions in Ecuador are so strange and exotic to a North American geologist that he is surprised to find the fundamental economic geology of the Zaruma district conforming closely to the type of Rocky Mountain mining camps. The differences are obvious; the covering of tropical vegetation, the more deeply weathered soil, the paucity of fresh outcrops; but the resemblances when the geology is once worked out are not less striking.

"Thus the ore at Zaruma occurs in fissure veins which form a linked-vein system in and adjacent to a granitic intrusive cupola. A certain portion of the intruded country rock is most favorable to the formation of these veins; the ore is largely confined to this portion. The mineral in the veins is deposited in a series of primary zones, the hotter zones closest to the intrusive. Post-mineral faulting is common and the faults tend to follow the lines of weakness represented by the earlier vein-filled fissures. Secondary enrichment is present.

"All of the statements could be made with equal correctness about many of the mining districts of the Cordillera region—the Cœur d'Alenes, Butte, Park City, Bingham, Tintic, for example—and one is tempted to diverge into a study of the similarity of ore deposits, which might be fully as profitable as the more usual studies of the classification of ore deposits.

"A brief outline of the geological features of the Zaruma district shows that a favorable horizon in the country rock, the Portovelo formation, has been intruded by a series of stocks and sills, some of which, the Sorocho-Sesmo intrusives, have been of a type suitable to generate mineral solutions. Fissuring, uplift, and tilting followed the intrusions and the characteristic linked-vein system received a filling of vein minerals which arranged themselves in temperature zones outward from their source.

"Gold accompanied these minerals and was deposited in primary oreshoots in the upper part of the Portovelo formation, particularly in the heavy sphalerite and quartz-calcite zones of mineralization.

"The adjustment of stresses continued on after the mineralization had ceased, resulting in post-mineral faulting, the movements showing a large horizontal component. The general effect of all the tilting and faulting has been to uplift relatively the northeastern portion of the district and to depress the southwestern.

"The subsequent progress of erosion has tended to re-establish a horizontal surface across the tilted country and has thus worn more deeply into the northern and eastern parts of the district so that there only the roots of the veins remain. Under favorable conditions of deep oxidation and enrichment, these have yielded commercial ore, but the bulk of the district's production is coming from the primary oreshoots which, in the southwestern area, still remain below the present surface of the country."

Men You Should Know About

Carl O. Lindberg, of Los Angeles, is in New York.

William Spence Black is in Clinton, N. Y., and will return to Boston next week.

L. E. Whicher, vice-president of the United Verde Extension Mining Co., is in the Jerome district.

W. H. Staver, of New York City, has returned after five months in Brazil investigating mineral deposits in Minas Geraes. He plans to return to Brazil in a few months.

Lester W. Strauss, mining engineer of New York City, made an examination of various tin properties in Bolivia in October, later going to Peru before returning to Valparaiso, Chile.

J. S. Olmstead, plant superintendent of the New Cornelia Copper Co. and associated with the operation of the plant since its beginning, is now making his home at Grafton, Mass.

Noah A. Timmins, president of the Hollinger Consolidated, of Porcupine, northern Ontario, has been elected a director of Noranda Mines, Ltd., operating in the Rouyn gold field of Quebec.

Charles E. Valentine, of Boston, a director of the Central Manitoba Mining Co., has returned from an inspection of the property of the company in the Bulldog Lake-Long Lake area of Manitoba.

R. H. Englekling, who has been operating in the Peras district, west of Oaxaca, Mexico, for about three years, is in Milwaukee arranging the financing of some properties in the Taviche district.

Charles E. Nathhorst, general manager of the Great Southern Mining Co., which is operating in the Wickenburg, Ariz. district, is in New York purchasing mining equipment for his company.

B. R. Bates, of the Dorr Company, returned to New York on Nov. 16 from South Africa, where he had been for the last few months on business connected with the company's interests in that country.

Frank Corwin, assistant manager and chief engineer with the United States Metals Refining Co., has just returned from a professional visit to Minas de Matahambre, S. A., Matahambre, Province de Pinar del Rio, Cuba.

Ernest N. Patty, professor of geology and mineralogy at the Alaska Agricultural College and School of Mines, has been elected dean of the college. He will also continue his work as professor of geology and mineralogy.

J. B. Tyrrell, of Toronto, sailed on the "Aquitania" from New York on Wednesday, Dec. 2, to explain the recent discoveries of ore at the 2,000-ft. level of the Kirkland Lake mine to the English financial backers, the Anglo-French Exploration Co. He expects to be away about two weeks.

James Hebbard, formerly manager of the Central mine, Broken Hill, Australia (the Sulphide Corporation, Ltd.),

is now practising as a consulting mining engineer. He has recently visited the Northampton lead mines, in Western Australia, on behalf of an Adelaide company holding options.

George J. Young, associate editor of *Mining Journal-Press*, is now in New York, where he will remain until Jan. 16, 1926, engaged in editing the Annual Review number of the *Mining Journal-Press* which will be published, Jan. 16, 1926.

Arthur B. Parsons, assistant editor of *Mining Journal-Press*, has returned to New York after a month's journey in Mexico. He spent some time at Monterey, Charcas, San Luis Potosi, Pachuca, Guanajuato, Zacatecas, Fresnillo, Torreón, Parral, Chihuahua, and Santa Eulalia, visiting the important



Arthur B. Parsons

mining, milling, and smelting operations in the vicinity of each of these places. In Mexico City, as well as in the operating centers, he discussed political and economic conditions with people engaged not only in mining but in various other fields. He obtained both the Mexican and "foreign" viewpoint, and the result of his interviews will be reflected in an article on the general situation to be published in an early issue of *Mining Journal-Press*. This will be followed by a series of a more technical nature, based on observations in the various mining and smelting districts. Mr. Parsons is deeply appreciative of the friendly hospitality of the mining fraternity in Mexico. He is particularly impressed with the size and importance of the many new projects that are in hand, and with the up-to-dateness of the engineering and technical work that is being done.

F. H. Viets, chief engineer for the Western Precipitation Co., left Los Angeles on Nov. 10 for Cementon, N. Y., to place in operation a recently constructed precipitator for the Alpha Portland Cement Co. While in the East he will visit various other cement

plants having electrical precipitation installations.

Gerald R. Simpson, of the Simpson Engineering Co., of Long Beach, Calif., has just returned from a trip to Phoenix, Tucson, and Nogales, Ariz., during which he visited the Phoenix State Fair, the Arizona Mining Congress, and several mills in which Simpson pneumatic flotation cells are being installed.

W. F. Hartmann, formerly superintendent of the Mohawk mine of the Mohawk Mining Co., operating in the Michigan copper district, has been appointed acting manager of the Seneca Mining Co., succeeding the late **W. J. Uren**. The appointment was made by **R. M. Atwater, Jr.**, vice-president of the company, who has returned to New York after a visit to the property. Mr. Hartmann has assumed his duties. He has had many years' experience in the mining of the Kearsarge lode. He resigned his position with the Mohawk early in the year.

C. L. Berrien, general superintendent of the Anaconda Copper Mining Co.; **Mauri Gidel**, **Frederick Gaethke**, **George C. Heikes**, **Ernest Klepetko**, **M. C. Messner**, and **G. W. Wegner**, geologists and metallurgists of Anaconda, are on their way to inspect the Giesche Erben property in Silesia and Poland for the Anaconda-Harriman interests. The latter are the prospective purchasers and under an agreement are permitted to make a thorough examination before signing the papers. The von Giesche works have a capacity of 150,000,000 lb. of zinc annually and the output will be greatly increased if control changes. The coal mines underlying the zinc property are among the most important in Germany.

Obituary

George W. Teagarden, prominent for thirty years in the mining industry in Clear Creek County, Colo., died on Nov. 6. Surviving are his widow, one son and three daughters.

Thomas F. Burns, secretary-treasurer of the Portland Gold Mining Co., an early entrant into the Cripple Creek, Colo., field, died suddenly at his Colorado Springs home on Nov. 1. He came to Colorado from Portland, Me., with his brother, the late James F. Burns, one of the original locators of the Portland group of mines at Victor, Colo. His widow and two sons survive him.

Frank Wood Carnahan died in Eugene, Ore., on Oct. 22, at the age of sixty-two. He was born at Cadiz, Ohio, and educated at West Point, being graduated with the class of 1885. Mr. Carnahan was manager of the Blue Ledge Mine, in northern California, for twelve years, and had done professional work, also, in South Carolina, South America, in Mexico, and in Leadville, Colo. He had also contributed many papers to the technical press. He had lived in Medford and Jackson County, Ore., for twenty years, and was held in high regard by a wide circle of friends and acquaintances. He is survived by his widow.

Recent Technical Publications

Reviews, Abstracts, and References

A State Bulletin on Limestone

Limestones of Pennsylvania. By Benjamin Le Roy Miller, Topographic and Geologic Survey of Pennsylvania, Harrisburg, Pa. Bulletin M7.

This is the fourth State Survey bulletin on limestone that has appeared during 1925, the three preceding reports covering the limestones of Florida, Illinois, and Wisconsin respectively. The importance of the Pennsylvania report of 368 pages, fifteen plates, seven figures and one map may be judged from the fact that, after fuels, limestone and its products occupy a leading place among the mineral resources of a wealthy and populous industrial state.

The first fifty-six pages are devoted to consideration of the character, origin, and uses of limestone and dolomite. The uses include building, crushed and pulverized stone, flux, cement, lime, furnace lining, magnesia manufacture, and chemical and agricultural applications. The great bulk of all the limestone produced in Pennsylvania is employed either for portland cement or lime manufacture, for furnace flux, or as crushed stone.

After the general outline of geographic and geologic distribution the deposits are described by geologic formation under subheadings of the various counties, this section of the report occupying over 280 pages. Thereafter the limestone resources are summarized, and the future prospects of the various branches of the industry are discussed.

For the prospective quarryman possibly an arrangement by counties with subheadings of the various geologic formations would be more convenient, as it would assemble all the data on each county in one place. The book is excellently written by one who is a recognized authority on the mineral resources of the state, and it contains extensive data of interest and value to the general reader, and particularly to those either directly or indirectly interested in the utilization of limestone or any of its numerous products.

OLIVER BOWLES.

Smithsonian Report—The annual report of the Smithsonian Institution for 1924 is now available, price \$1.75 from the Superintendent of Documents, Washington, D. C. As usual, many interesting articles, on scientific subjects but of popular appeal, and well illustrated, are included. Such, for example, as: "The Origin of the Solar System," by J. H. Jeans; "The Electrical Structure of Matter," by Sir Ernest Rutherford; and "Clear Fused Quartz Made in the Electric Furnace," by Edward R. Berry.

Bureau of Mines—The annual report of the Director of the U. S. Bureau of Mines for the fiscal year ended June 30, 1925, is now available. The bulletin describes briefly the work of the bureau for the year under review. It consists of 70 pages, and may be obtained for 15c. from the Superintendent of Documents, Washington, D. C.

African Bauxite—A. E. Kitson has a 6-page article in the November issue of *The Mining Magazine* (London; price 1s.) on "The Bauxite Deposits of the Gold Coast." Large deposits have been discovered by the Geological Survey, characteristic analyses running between 60 and 61 per cent alumina, between 9 and 10 per cent ferric oxide, about 2 per cent titanium oxide, 1 per cent silica, and 26 per cent water.

Hydrometallurgy of Copper—The Australian Minerals Recovery Co., Ltd., 81 St. George's Terrace, Perth, West Australia, has published a booklet descriptive of the Metallic Contact Process for the extraction of copper, gold, and silver from ores. This process is said to be especially adaptable to low-grade oxidized ore deposits, using less than one-hundredth of the acid used in ordinary leaching operations, insuring a much higher economy of iron for precipitation, and being much more rapid. It was described (as the Nevill-Soanes Process) in *Mining Journal-Press* of Aug. 4, 1923, page 195, and is now in commercial use at the works of Copper Separation, Ltd., at Ravenshorpe. There the cement copper is floated, much of the sulphide copper also appearing in the float. Most of the gold and silver is precipitated with the cement copper.

Mineral Resources—The U. S. Bureau of Mines has issued the following bulletins in the "Mineral Resources, 1924," series: "Carbon Black Produced From Natural Gas," by G. B. Richardson, three pages; and "Phosphate Rock," by George Rogers Mansfield, 35 pages. The first is obtainable for 5c., and the second for 10c., from the Superintendent of Documents, Washington, D. C. Phosphate rock production recorded a slight decline in 1924 compared with 1923, though Tennessee blue rock and the phosphate industry in the Western states made noteworthy gains. The bulletin contains several pages on phosphate mining in foreign countries.

The Lead Industry—The U. S. Department of Commerce is issuing a series of bulletins prepared by R. M. Santmyers on "The Lead Industry." Part 1 of this survey covered the countries of North and South America and Oceania, being issued as Trade Information Bulletin No. 268. Bulletin No. 371, which is Part 2, covering Europe, Asia, and Africa, has just appeared. Either may be had for 10c. each from the Superintendent of Documents, Washington, D. C. The bulletins are made up of reports from U. S. Trade Commissioners in foreign countries, giving a brief history of important deposits, production, consumption, imports and exports, and the general economic situation of lead.

A. I. M. E.—Vol. 71 of the *Transactions* of the American Institute of Mining and Metallurgical Engineers, 29 West 39th St., New York City, has been issued. This is a volume of 1,420 pages.

Weights and Measures—"History of the Standard Weights and Measures of the United States," by Louis A. Fischer, has been issued as Bulletin No. 64, Miscellaneous Publications, of the U. S. Bureau of Standards, 34 pages, price 15c. from the Superintendent of Documents, Washington, D. C. The bulletin is interestingly written and, of course, authoritative.

Idaho Copper—U. S. Geological Survey Bulletin No. 774, by Clyde P. Ross, discusses "The Copper Deposits Near Salmon, Idaho." The district has been a small producer. Copies are obtainable for 15c. from the Superintendent of Documents, Washington, D. C.

Philippine Islands—"The Mineral Resources of the Philippine Islands for the Years 1921, 1922, and 1923," 63 pages, has been issued by the Division of Geology and Mines, Manila. Gold is the most important mineral product there, followed by coal; the production of both is on the increase. The convenience of using this bulletin would be improved if the pages were cut.

Patents

Metal Refining—Reissue No. 16,213. Nov. 17, 1925. Henry Harris, London, England. Apparatus for refining molten metal by passing it through a molten reagent.

Rock Drilling—No. 1,561,580. Nov. 17, 1925. G. R. Watson, Waterloo, Iowa, assignor to Armstrong Manufacturing Co., Waterloo, Iowa. Design for a drill bit.

No. 1,561,975. Nov. 17, 1925. H. H. Des Roches, Butte, Mont., assignor of one-half to Frank F. Hayes, Butte. A drill bit with a cutting face formed of four spaced pyramids.

No. 1,562,864. Nov. 24, 1925. Frank Brososky, Haywood, W. Va. Design for a drill and supporting device.

No. 1,557,743. Oct. 20, 1925. Albert Terrill, Haileybury, Ont. Design of a steel bit for rock drills.

Molybdenum—No. 1,562,125. Nov. 17, 1925. W. H. Rideout, Porthill, Idaho. Molybdenum ore is reduced with water to a fine pulp, and then to every gallon of the pulp is added two gallons of a mixture made up as follows: Water, 90 gal.; paraffin, 10 gal.; soda, 4 oz.; and lye, 1 lb. The mixture is then agitated and allowed to stand until the compound, carrying the molybdenum, floats to the surface, from which it is removed.

Zinc Condenser—No. 1,562,473. Nov. 24, 1925. Øystein Ravner, Christiania, Norway, assignor to Det Norske Aktieselskab for Elektrokemisk Industri, Christiania. A condenser for zinc vapors comprising a revolving drum and a stationary tube connected with it so that the condensate formed in the tube will automatically fall back into the drum.

Crushing Rolls—No. 1,562,617. Nov. 24, 1925. H. K. Burch, Los Angeles. Device for separating the oversize and undersize from crushing rolls.

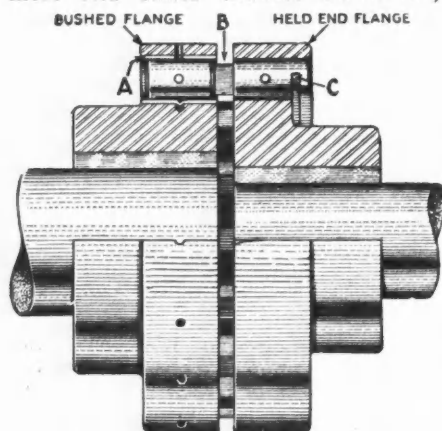
Grinding—No. 1,562,618. Nov. 24, 1925. H. K. Burch, Los Angeles. A combination of coarse and fine-grinding mills with classifiers for returning oversize material.

New Machinery and Inventions

New Flexible Coupling Is Simple, Rugged, and Safe

A line of improved Francke flexible couplings for motor, turbine, and engine drives has been introduced by the maker. These are known as the bushed pin type. There are twenty-one regular sizes rated from $\frac{3}{4}$ hp. per 100 r.p.m. (4,000 r.p.m. maximum) up to 3,850 hp. per 100 r.p.m. (490 r.p.m. maximum) and or shafts from $\frac{1}{4}$ in. diameter up to 13 in. diameter.

The new coupling retains the best features of the old heavy-pattern type and has several new features, namely: more and easier endwise movement;



Section of bushed-pin-type coupling

The particular feature of this coupling which chiefly distinguishes it from all others is the renewable bronze or graphited bushings within which the flexible pin members are mounted and slide. These greatly reduce the friction of the pins and should last for years. A, renewable bronze or graphited bushing. B, flexible steel pin units. C, spring retaining ring.

greater power and bore capacities, much longer life for all speeds, and steel flanges for small and intermediate sizes.

As may be seen in the accompanying drawing, this new coupling retains the good features of its predecessor, known as the "heavy-pattern type," and embodies several new ones of its own. Thus the end movement is easier and of greater amplitude. The power-transmitting qualities are greater, as are also the bores. The new coupling also should have a longer life at all speeds. Steel flanges have been used on the small and intermediate sizes.

Graphited bronze bushings will be used in No. 850 size and larger, and bronze bushings will be employed in the smaller couplings. These bushings are removably locked to one flange, and the steel-pin units are free to slide a full half inch within them. As compared with the older bushings the area of the contact surfaces is more than doubled, and movement takes place between steel and bronze. Graphited bushings present self-lubricated surfaces that retain their lubricating qualities for many years.

This new coupling is capable of handling all accidental misinstallations, such as the shaft being out of center or out of line and the like. The flexible pins cushion starting and load shocks

and absorb vibrations. The coupling is noiseless and capable of operation in either direction. In case of excessive misalignment such a coupling acts as a safety device, obviating broken or scored shafts, bearing troubles and the like. However, if more than usual misalignment is anticipated, due to non-rigid foundations or from any other cause, two couplings in tandem with an intermediate shaft between them or a double, floating-ring type of coupling should be employed.

These new couplings are easily mounted, aligned, and fastened to the shafts they join without the aid of any special tools. They are of all-metal construction and embody no perishable material. There is no movement or wear on the shaft flanges to result in excessive renewal expense of these parts or of the complete coupling. The entire device is simple, rugged in construction, and safe in operation.

Multiple-Dial Draft Gage Aids in Boiler Control

In most boiler installations if continued high efficiency is to be maintained it is essential that the fireman should know accurately the draft intensity existing not only in the breeching or stack but also in the ashpit, above the fire and if possible in each pass of the boiler. Heretofore it has been necessary in most cases to employ a separate gage for each pressure desired. To make all of these various readings discernible at a glance as well as to render them continuously comparable one with the other the Republic Flow Meters Co., of Chicago, is introducing the instrument shown in the accompanying illustration.

This meter is made in various sizes with units ranging from three to twelve in number. It may be placed in any convenient location, usually on the front of the boiler, each component unit being connected to the point in the boiler setting where a reading on the draft is desired. An electric light housed within the curved reflector spanning the top of the instrument illuminates all of the dials uniformly and makes them easy to read and compare.

In construction this instrument is simple. One leg of a U-tube containing a non-volatile oil is exposed to the pressure to be measured. The other leg of this tube contains a counterbalanced float, which in rising and falling actuates a gear quadrant meshing with a pinion the shaft of which carries a rotating dial. The dial somewhat resembles that of a speedometer, its readings possessing equally easy legibility. By placing the dials connected to the various points of the setting in sequence, not only may the actual pressures or vacua be read directly, but the relative differences between adjacent points, such as the boiler passes or the wind boxes of the stoker, are at once apparent. Any marked variation from normal in these relative values indicates a change of condition within the furnace that requires investigation.

Magnetic Pulleys for Use in Pan Conveyors

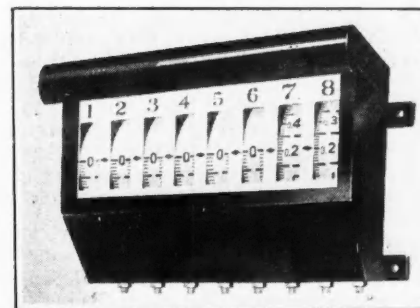
A new type of magnetic pulley adapted to operate in the discharge end of steel-apron or pan conveyors has been announced by the Magnetic Manufacturing Co., of Milwaukee, Wis. It is the result of several years of experimental work and is of especial interest to plants using steel apron or pan feeders for feeding rock or ore directly from bins into crushers or pulverizers.

Equipped with a magnetic pulley, the discharge end of the apron or pan feeder becomes a powerful magnetic field, ready to reject any of the troublesome tramp iron, in the same manner as the customary magnetic head pulley. In plants where it is difficult to provide the necessary room for installing a magnetic separator to eliminate tramp iron, it is a simple matter to introduce one of these magnetic pulleys into the pan-conveyor feeders, without elaborate changes in construction.

The poles of the pulley are brought into close contact with the underside of the steel apron, and the design of the magnet is such as to cause a penetration of the magnetic lines of force through the steel apron plates. To produce the best results the magnet coils are made very large, and the pole pieces are made to conform to the shape of the apron plates used, thus making the magnetic pulley of polygonal form.

Owing to the unusually heavy loads carried on this type of conveyor, it was found that the standard type of magnetic pulley could not be used with the best results, when due consideration had been given to the depth of material to be handled. The pulley is mounted on the shaft between the regular drive sprockets, the shaft having a drive extension on the other end.

Where desired to equip existing conveyors with this new style of magnetic pulley, it is advisable to provide the magnetic pulley unit with new shaft and sprockets, so that a quick change can be made when inserting the magnetic unit into position. No additional power is required to drive the apparatus, outside of the direct current required on the magnetic pulley. When no direct current is available for operation, a small-unit motor generator is usually used to supply the necessary direct current for the magnet.



Boiler control is facilitated by this new gage

The fireman can see at a glance the draft intensity in breeching, stack, and ashpit as well as above the fire and in each pass of the boiler—and he can compare them readily.

The Market Report

Metal Markets Have Quiet Week

Copper Price Decline Continues, and Lead and Zinc Prices Also Weaken Owing to Lower London Market

New York, Dec. 2, 1925—Metal producers have little to be optimistic over in the present state of the market, though consumption continues as great as ever and there seems no prospect of an early slump in manufacturing operations. Buying of metals generally has been in only limited volume in the week ending today. The London market has declined for all metals except

tin, zinc being particularly weak compared with former quotations. Lead, too, has suffered an appreciable decline. Apparently Europe is getting along well without American zinc, in spite of arguments that Continental consumers must soon come into the market, and the foreign market also seems willing to have the United States absorb a little Canadian and Mexican

lead. It was hoped that the signing of the Locarno peace pact would have at least a favorable sentimental effect on foreign markets, but today the London cables showed all metals off an appreciable amount from yesterday's closing prices. Bismuth has registered another of its infrequent changes, the dominating London interests going counter to the general tendency and yesterday advancing the price 25 per cent.

London has had an undue influence in the American metal market, as most of the consumption is here, where economic conditions are as good as ever. It is true that American buyers watch the foreign market closely, and if weakness is detected hold off buying longer than is their custom, and thus depress the American market for the time being. Zinc, for example, in spite of its excellent statistical position, has declined a little in the St. Louis market, though not nearly in proportion to the lowering of the foreign price in recent weeks.

Average prices for November are given on page 917.

Daily Prices of Metals

Nov. Dec.	Copper N. Y. net refinery*		Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.	
26	Holiday	.....	.....	.....	.....	.....
27	14.125	62.00	63.125	9.725	9.50	8.80	
28	14.125	62.625	63.625	9.70	9.50	8.80	
30	14.00@14.125	62.875	63.875	9.55	9.375	8.50@8.75	
1	14.00	62.625	63.625	9.50	9.35	8.50@8.60	
2	13.875	62.50	63.50	9.50	9.325	8.375	
Av.	14.038	62.525	63.550	9.595	9.410	8.630	

*The prices correspond to the following quotations for copper delivered: Nov. 26th, Holiday; 27th and 28th, 14.375c.; 30th, 14.25c.@14.375c.; Dec. 1, 14.25c.; 2nd, 14.125c.

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

Nov. Dec.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
26	60 ³ / ₈	61 ³ / ₈	67	286	281 ¹ / ₄	35 ⁷ / ₈	35 ¹ / ₂	39 ¹ / ₂	38 ³ / ₁₆
27	60 ³ / ₈	61 ³ / ₈	67	286 ³ / ₈	281	36 ³ / ₁₆	35 ¹ / ₂	39 ⁷ / ₁₆	38 ³ / ₁₆
30	60 ³ / ₈	61 ³ / ₈	67	288 ³ / ₈	282 ⁵ / ₈	36	35 ³ / ₈	39 ¹ / ₁₆	37 ⁷ / ₈
1	60	61	66 ³ / ₄	288	282 ³ / ₈	35 ³ / ₁₆	34 ⁵ / ₈	38 ¹ / ₂	37 ⁵ / ₈
2	59 ³ / ₄	60 ³ / ₄	66 ¹ / ₄	286 ¹ / ₄	281	34 ¹ / ₁₆	34 ⁷ / ₁₆	38 ⁵ / ₁₆	37 ¹ / ₄

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

Nov.	Sterling Exchange "Checks"	Silver		Gold London	Nov. Dec.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
26	Holiday	...	32 ¹ / ₂	84s11 ¹ / ₂ d	30	4.84	69 ¹ / ₂	32 ¹ / ₂	84s11 ¹ / ₂ d
27	4.84 ¹ / ₈	69 ¹ / ₈	32 ¹ / ₁₆	84s11 ¹ / ₂ d	1	4.84	69 ¹ / ₂	32 ¹ / ₁₆	84s11 ¹ / ₂ d
28	4.84 ¹ / ₈	69	32	...	2	4.84	69 ¹ / ₂	32	84s11 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.

The total volume of business is much less than that reported last week, even allowing for the Thanksgiving holiday, when all domestic markets were, of course, closed. A normal amount of business was in the offing, but it has been scared away, and as consumers are well provided for current requirements, they are not likely to come into the market until a more stable price level is established. The largest sellers seem well content not to sell much metal, and are generally quoting above the market, but the metal offered by two or three interests is more than sufficient to supply what little demand exists.

Most of the foreign agencies of American producers continue to quote at from 14³/₈@14.45c., c.i.f., but secondhands offered February copper as low as 14.325c. today.

Smelting Company Cuts New York Lead to 9.50c.

The American Smelting & Refining Co. on Nov. 30 cut its official contract price for New York lead from 9.75c. to 9.50c., this being the first reduction since June 30, when the price was fixed at 8c. per lb. Since then the trend has been steadily upward. The continued weakness of the London market is largely responsible for the marking down of the domestic price. For some weeks it has been advantageous to market foreign-ore lead in the United States after paying the duty, and at the levels prevailing recently lead bullion bearing an import duty of 2½c. per lb. would net the producer more here than it would abroad. Consequently, considerable metal from Mexico and Canada was sold in the domestic market. As London continued to weaken rather than strengthen, a decline in the price on this side was logical. So far as consumption in the United States is concerned, there seems to be little or no slacking. Deliveries on contract by the principal producers for December continue in the large volume of recent months. With the possible exception of the paint industry, there is no abatement in the high rate of consumption.

The leading interest in the Middle West has been asking 9.35c. at St. Louis since the Smelting company's cut. In line with its policy to stabilize the market, it had endeavored to maintain a differential of 0.25c. per lb. between the two prices, but it now feels under no obligation to continue this spread. Moreover, much of the lead bullion from foreign ores has arrived on the Eastern seaboard and affects the market here rather than in the Middle West. One large consignment of antimonial lead brought a good premium over common, and the premium for corroding grades ranges from \$2 to \$4.

The average price of London forward lead in November was £36.211.

No Spot Tin To Be Had

The market is virtually bare of spot tin, both Straits and 99 per cent being hard to obtain, prior to the arrival of boats now afloat that are due between Dec. 10 and 15. Total deliveries in the domestic market in November were 5,670 tons, which was in line with expectations, a small increase in the world's supply being indicated. The relative scarcity of spot 99 per cent metal is more acute, and the premium on Straits is only about one cent per pound. This is probably due to the substitution of the lower-grade metal by consumers who usually demand Straits tin.

Zinc Declines Slightly

The volume of zinc sales is somewhat less this week than last, buyers holding off in the hope of lower prices. Stocks of zinc are so low, however, that producers are little disposed to dump the metal on the market, holders of spot zinc demanding full prices, regardless of the sharp decline in London. Some galvanizers have had to buy limited tonnages for immediate needs, but the sale of forward zinc has not been such

a predominating influence in the market as it was two or three weeks ago. Today, prompt zinc sold for about 8.50c., with 8.40c. asked for December, 8.35@8.375c. for January, and 8.30@8.35c. for February. A good tonnage was sold.

Brass Special continues scarce, especially for early delivery. On the average, it is quoted about 0.2c. per lb. above Prime Western. High-grade zinc is unchanged at 10¼@10½c. delivered.

Silver Steady

Silver has been in fairly good demand during the last week, but prices have shown no improvement notwithstanding. On the contrary, the London quotation declined, and it was only through local orders direct from India that the New York market was maintained. At the close business is again quiet.

Mexican Dollars: Nov. 26th, holiday; 27th, 53c.; 28th, 52½c.; 30th, 53½c.; and Dec. 1st, 2d, 53c.

Money Exchanges Unsettled

Francs have moved in an erratic fashion, while sterling has held steady. Polish zloties dropped from about 14c. to 10c. during the week. Closing cable quotations on Tuesday, Dec. 1, were as follows: francs, 3.88c.; lire, 4.02c.; and marks, 23.81c. Canadian dollars, ½ per cent premium.

No Price Change in Zinc Blende or Lead Ore

Joplin, Mo., Nov. 28, 1925

Zinc Blende	Per Ton
High	\$63.60
Premium, basis 60 per cent zinc	\$59.00 @ \$60.00
Prime Western, 60 per cent zinc	\$58.00
Fines and slimes, 60 per cent zinc	\$56.00 @ \$53.00
Average settling price, all..	\$57.79
Galena	Per Ton
High	\$131.30
Basis 80 per cent lead.....	\$125.00
Average settling price, all..	\$125.89

Shipments for the week: Blende, 19,307; lead, 3,615 tons. Value, all ores the week, \$1,570,950.

Shipment for eleven months: Blende, 753,260; calamine, 579; lead, 117,027 tons. Value, all ores eleven months, \$53,369,410.

Purchases this week were 16,000 tons, with a production limited to 17,000 on account of mines closing for Thanksgiving. Buyers appeared willing to accept all ore purchasable on \$58 basis Prime Western, with a few sellers declining to accept that price. Producers estimate the average output around 17,000 tons, and some buyers place estimates as high as 18,000 tons. The figure dividing these two extremes is probably nearest correct.

There are perhaps 5,000 to 7,000 tons of unsold ore in the bins, but a like amount sold ahead of production practically eliminates all reserve stocks.

Platteville, Wis., Nov. 28, 1925

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	\$ 60.50
Lead Ore	Per Ton
Lead, basis 80 per cent lead	125.00

Shipments for the week: Blende, 851

tons; lead, 80 tons. Shipments for the year: Blende, 42,479; lead, 2,151 tons. Shipments for the week to separating plants, 1,853 tons blende.

Steel Active—Pig Iron Quiet—Coke Still Lower

Pittsburgh, Dec. 1, 1925.

The steel market continues the remarkable activity shown in the last two months, but at points there is a recession, from special conditions.

Finished steel prices are firm all along the line, with stiffening tendency in spots, but no clear-cut advances observed in the last week.

Steel-mill operations have had little change of late, but in general have been at a trifle above the October rate, whereby the rate of ingot production may be estimated at over 45,000,000 tons per annum, and the balance of probability seems to be that this year will make a new tonnage record by a small margin.

Pig Iron.—The market continues quiet but firm. The recent further sagging in coke makes consumers still less interested. Bessemer, \$21; basic, \$20; foundry, \$20.50, f.o.b. Valley furnaces.

Connellsville Coke.—The market has sagged farther, there being offerings of standard furnace coke for several days at \$4, which have been absorbed, but not very readily. Prospects are diminished that there will be another sensational rise. Spot foundry coke is offered at \$5@5.50.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified.

Aluminum—99 per cent, 29c. per lb.; 98 per cent, 28c. London, 98 per cent, £118 long ton. Domestic market firm, with good demand. Improved demand in Great Britain. Average price for November, 98 per cent, 28c.

Antimony—Per lb.: Chinese brands, spot, 19¾@20¼c.; January 19½@19¾c. Cookson's "C" grade, spot, 21¼c@21¾c. Chinese needle, lump, 15@16c. Standard powdered needle, 200 mesh, 19½@20c. White oxide, Chinese, 99 per cent Sb₂O₃, 19@19½c.

Bismuth—\$2.65@2.70 per lb., Nov. 28 to 30. \$3.25@3.30. Dec. 1 and 2. London advanced to 12s. 6d.

Cadmium—60c. per lb. London, 1s. 9d. for Australian metal.

Cobalt—Shot, 96@98 per cent, \$2.50 per lb. Black oxide, 70 per cent, \$2.20; gray oxide, 75 per cent, \$2.35. London, 10s. for metal; 8s. for black oxide; 8s. 10d. for gray. Market good.

Germanium Oxide—25 to 50 gm. lots, \$6 per gm.

Iridium—\$390@\$400 per oz. for 98@99 per cent. Nominal. London, £80@£85 for 99.5 per cent.

Lithium—95@96 per cent grade in 1 to 5 lb. lots, \$65 per lb.

Magnesium—Ingot, 99.85 per cent, 90c. per lb. in ton lots. Market steady.

London, 3s. 9d.@4s. 3d. for 99 per cent ingots or sticks.

Molybdenum—99 per cent, \$25 per kg. C. P. metal, \$80 per kg.

Monel Metal—Base price for shot, 32c. per lb.

Nickel—Ingot, 34c.; shot, 35c.; electrolytic, 38c. (99.75 per cent grade). Market firmer, with increase of 2c. forecast for 1926. London, £170@£175 per long ton, according to quantity.

Osmium—\$110@\$115 per oz.; London, £23 10s.@£25 10s.

Palladium—\$78@\$82 per oz. Crude, \$60@\$65 per oz. London, £17, nominal.

Platinum—Refined, \$120 per oz. officially quoted. Sales also at \$115@\$118. Crude, \$113.50@\$114.50.

London, £23 15s. per oz. for refined, and £22 for crude. Demand limited.

Quicksilver—Per 75-lb. flask, spot, \$90@\$91; forward \$89. Spanish price £13½, f.o.b. mines. London, £14 15s.@£15. Market is quiet; spot metal scarce.

Radium—\$70 per mg. radium content.

Rhodium—\$80@\$95 per oz.; London, £18@£22.

Ruthenium—\$95@\$105 per oz.; London, £16½@£19½.

Selenium—Black powdered, amorphous, 99.5 per cent pure, \$2 per lb. in ton lots.

Tellurium—\$2 per lb.

Thallium Metal—Ingot, 99 per cent pure, \$6 per lb. in 25-lb. lots.

Tungsten Powder—97 to 98 per cent pure, \$1.18@\$1.20 per pound.

Zirconium Metal—98 per cent grade, per lb., \$30, in 5 to 10 lb. lots.

Metallic Ores

Chrome Ore—Crude, 45 to 50 per cent Cr₂O₃, \$22.50@\$23 per net ton, f.o.b. shipping point. Demand good.

New Caledonian, 52-54 per cent Cr₂O₃, \$24; nominal.

Galena Radio Crystals—Best quality (50 per cent of sized fragments good) 50c. per lb. in 500-lb. lots, f.o.b. Philadelphia.

Iron Ore—Lake Superior ores, per long ton, lower Lake ports:

Mesabi, non-bessemer, 51½ per cent iron, \$4.25. Old Range, \$4.40.

Mesabi, bessemer, 51½ per cent iron, \$4.40. Old Range bessemer, 51½ per cent, \$4.55.

High-phosphorus foundry, over 0.18 per cent P, \$4.15.

Stocks at Lake ports greatly reduced and higher prices expected next year.

Eastern ores, cents per unit delivered at furnaces: Foundry and basic, 53 to 63 per cent, 9@10c.

Foreign ores, f.o.b. cars Atlantic ports, cents per unit:

Swedish and Norwegian, low-phosphorus, 68 per cent, 11@11½c.

Spanish and Algerian, low-phosphorus, 52@54 per cent, 9@10c.

Spanish foundry or basic, 50@54 per cent, 8½@9c.

Swedish foundry or basic, 66@68 per cent, 9@10c.

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.; market has been dull.

Chemical grades¹, powdered, coarse or fine, 82@87 per cent MnO₂, Brazilian and Cuban, \$70@\$80 per ton in carloads.

Molybdenum Ore—65@70c. per lb. of MoS₂ for 85 per cent MoS₂ concentrates, f.o.b. mines. Market firm.

Pyrite Radio Crystals—50c.@\$1 per lb.

Tantalum Ore—Foreign, 75c. per lb. of Ta₂O₅ contained, c.i.f. New York.

Tungsten Ore—Per unit of WO₃, N.Y.: Wolframite, ordinary, \$11.50@\$12; high-grade, \$12.25@\$12.50.

Scheelite, ordinary, \$12.50; high-grade, \$12.75. Prices firm; market remains quiet. Domestic production for 1925 below expectations.

Vanadium Ore—Minimum 18 per cent V₂O₅, \$1@\$1.25 per lb. V₂O₅. Nominal.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can only serve as a general guide to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can only be ascertained by direct negotiation between buyer and seller.

Amblygonite—8@9 per cent lithium oxide, \$50@\$60 per ton, f.o.b. mines.

Andalusite—Sorted, \$45@\$50 per ton, f.o.b. South Dakota mines. Sales mostly for experimental lots.

Asbestos—F.o.b. Quebec mines, tax and bags included, per ton:
Crude No. 1, \$475; crude No. 2, \$275 @ \$300; spinning fibers, \$175@\$200; magnesia and compressed sheet fibers, \$125; shingle stock, \$70; paper stock, \$40@\$45; cement stock, \$25; short fibers, \$12@\$15.

The market is good and prices are rising, apparently as consequence of expected consummation of merger. Scarcity of low-grade material.

No. 1 Rhodesian crude, \$310; No. 2, \$250 per ton, c.i.f. New York.

Barytes—F.o.b. mines, per ton, bags extra:

South Carolina: Crude, \$7@\$8 per gross ton; ground, off color, \$14@\$17 per short ton.

North Carolina: White bleached, \$22 per short ton; white natural, \$20.

Georgia: Crude barytes ore, \$7.50. Good demand but foreign competition has cut price.

Missouri: Water ground and floated, bleached, \$23@\$24, f.o.b. works.

Canada: 94@96 per cent BaSO₄, \$9 per net ton, f.o.b. mine.

Bauxite—American, f.o.b. shipping point per gross ton: Crushed and dried, \$5.50@\$8.50; pulverized and dried, \$14; calcined, crushed, \$19@\$20.

Foreign, per metric ton, c.i.f.: Dalmatian, low SiO₂, \$5@\$6.50; Istrian, \$5.50@\$6.50.

Dutch Guiana bauxite offered at \$8.50 per long ton, c.i.f. New York.

Borax—Carload lots, in bags, per lb.: crystals, 5c.; granulated or powdered, 4½c.; f.o.b. Pa. or Ill. Market normal.

Celestite—90 per cent SrSO₄, finely powdered, \$30 per ton in carload lots.

¹Price furnished by Foote Mineral Co., Philadelphia.

Chalk—Crude, in bulk, per ton c.i.f. New York, \$4.75@\$5.

China Clay (Kaolin)—F.o.b. Virginia mines, per ton: crude lump, No. 1, \$7; crude No. 2, \$5.50; washed, \$8; powdered and air-floated, \$10@\$20; ground, \$7@\$10.

Imported English, f.o.b. American ports: Lump, \$11.50@\$19; powdered, \$45@\$50.

Demand good and large tonnages being moved.

1A grades, domestic, \$16@\$17, f.o.b. Delaware plants. Market slower.

Diatomaceous Earth—Per short ton, f.o.b. plant, California:

Kiln-fired brick, \$65; kiln-fired aggregate, ¼ in., \$45; insulating powder, \$30; natural aggregate, ¼ in., \$20; air-floated powder, \$40; "Calatom" (mill run), \$20; "Calatom," 3b, \$30.

Emery—F.o.b. Pennsylvania and New York in 350-lb. kegs, per lb.: Greek Naxos, 6½c.; Turkish, 6½c.; Khassia, 5½c.; domestic, 3½c. Market good.

Feldspar—F.o.b. mine or grinding plant:

North Carolina: No. 1 pottery grade, \$6@\$6.50 per long ton, depending upon quality. Market fair.

New Hampshire: No. 1, not over 10 per cent SiO₂, \$8 per short ton. Ground, \$17. Market fair.

New York: Per ton, f.o.b. cars, No. 1 crude, \$8. Market good.

Maine: No. 1, ground, \$19 per ton. Heavy demand.

Tennessee: No. 1 pottery, \$16@\$18 per ton for 140 and 200 mesh respectively; No. 1 enamel, 140 mesh, \$15; 200 mesh, \$18. Competition keen with some cutting of prices to get business, but demand good.

Price cutting is complained of by some producers.

Maryland: Enamellers' grade, No. 1, \$16; Glassmakers' grade, No. 1, \$15; No. 2, \$11.50.

Canada, f.o.b. mine: High potash, \$9, f.o.b. per ton Quebec; crude, No. 1, over 12½ per cent potash, less than 5 per cent free SiO₂, \$7.50@\$8; crude, No. 2, 20 to 25 per cent free SiO₂, \$6.25@\$6.50. Demand good.

Ground, No. 1, 180 mesh, \$20.50 per ton, bags included; demand very active for first-grade feldspar.

Fluorspar—F.o.b. Kentucky and Illinois mines, per ton:

Gravel, not less than 85 per cent CaF₂, and not over 5 per cent SiO₂, \$16@\$18. Foundry lump, 85-5, \$19@\$19.50. Ground, 95 to 98 per cent CaF₂, and not over 2½ per cent SiO₂, \$32.50. Acid ground packed in bags \$40@\$45. Prices firm. Prices continue below cost of production at many mines. Market for ground fluorspar is good, however.

Canada: 84@86 per cent CaF₂, less than 5 per cent silica, \$16.

New Mexico: 85-5 lump or gravel, \$15 f.o.b. mines. Ground, 96 per cent, 100 mesh, \$35.

Fuller's Earth—Per ton, f.o.b. Midway, Fla.: 16 to 30 mesh, \$16.50; 30 to 60 mesh, \$18; 60 to 100 mesh, \$15; 100 mesh "up," \$8; 200 mesh "up," \$15. Market fair.

Powdered, imported, duty paid, \$23@\$25 per ton.

Garnet—Per ton f.o.b. mines:
Domestic, \$85; *Canadian*, \$70@80.
Spanish grades, \$60, c.i.f. port of
entry.

Gilsonite—Per ton, carload lots, f.o.b.
mines *Colorado*:

Jet asphaltum, \$36; selects, \$33; sec-
onds (ordinary grades), \$25.50; peer-
less black, \$32.90. Market steady.

Graphite—F.o.b. New York per lb.:

Ceylon lump, 8½@9½c.; chip, 7@7½c.;
dust, 3@5c. Market active.

Flake, 12@30c. according to grade;
fine ground crystalline, 8@25c.; amor-
phous ground graphite, 5@18c. Crude
amorphous graphite, \$15@35 per ton.

Prices have been improving steadily.
Higher labor costs in Ceylon and Mad-
agascar have been factor.

Greensand—Per ton, f.o.b. cars, *New
Jersey*: screened and bagged, \$20 in
carload lots. Being used as a dressing
for lawns and golf grounds and as a
mineral for water softening.

Gypsum—Per ton f.o.b. mill, depend-
ing upon location: crushed, \$1.50@3;
ground, \$4@6; agricultural, \$6@7;
calcined, \$8@11.

Ilmenite—Concentrates, 52 per cent
TiO₂, 1½c. per lb., f.o.b. *Virginia* points.
\$60 per short ton, *Florida* mines.

Iron Oxide (See Ocher)—Standard
Spanish red, 3@3½c. per lb.; domestic
earth, 2@4½c. Market a little stronger.

Kaolin—See China Clay.

Lepidolite—\$20@30 per ton for ordi-
nary grades. Nominal.

Limestone—F.o.b. shipping points,
depending on location: crushed, ½ in.
and less, 90c.@2; 3 in. and larger, 90c.
@\$1.80 per ton.

Agricultural, \$0.75@5 for pulver-
ized, depending upon source, purity,
and fineness.

Magnesite—Per short ton, f.o.b.
California mines: Grade "A," \$40;
Grade "B," \$38.

Dead-burned, \$40, f.o.b. Eastern sea-
board. Market unsettled.

Manjak—Barbados, in 10-ton lots,
c.i.f. New York: grade "A," 6c. per lb.;
grade "AA," fine, 8½c.

Mica—F.o.b. plant, per ton:

North Carolina: 20 mesh, roofing,
\$38; 100 mesh, white ground, \$70.
Market good.

New Hampshire: Mine run, \$320,
clean shop scrap, \$25; mine scrap, \$20.
White, dry ground, 20 mesh, \$35; 40
mesh, \$45; 60 mesh, \$60; 100 mesh, \$75;
200 mesh, \$85. Market good.

Madagascar, amber, dark, free from
iron, per lb., f.o.b. *New York*, duty
paid: special grade, \$3@3.25; No. A 1,
\$2.75; No. 1, \$2.50; No. 2, \$2.20; No. 3,
\$1.20; No. 4, 60@70c. No. 5, 42@45c.

Monazite—Minimum 6 per cent ThO₂,
\$120 per ton.

Ocher—F.o.b. *Georgia* mines, per
ton: \$22.50@25 in sacks; \$25@30 in
barrels; washed and water floated, \$25
@\$28. Market fair to good.

Phosphate—Per long ton, f.a.s. or
f.o.b. mines:

Florida, pebble, f.a.s., for export:
76@77 per cent, \$6.50; 75 per cent,
\$5.65; 74@75 per cent, \$5.40; 70 per
cent, \$3.50; 68 per cent, \$3.25. Market
firm; prices up slightly.

Tennessee, lump, 68 to 72 per cent,
\$4.50@5.50; ground, 65 to 72 per cent,
\$4@7.

Potash—

	Bags	Bulk
Muriate of potash 80@85 per cent, basis 80 per cent....	\$34.90	\$33.65
Sulphate of potash 90@95 per cent, basis 90 per cent....	45.85	44.60
Sulphate of potash-magnesia 48@53 per cent, basis 48 per cent	26.35	25.10
Manure salt 30 per cent....	20.00	18.00
Manure salt 20 per cent....	13.35	11.35
Kainit 14@16 per cent....	10.50	8.50
Kainit 12.4 per cent.....	10.00	8.00

Two thousand pounds net weight,
c.i.f. Atlantic and Gulf ports. German
weights, tares and analyses.

Discounts: 5 per cent on minimum of
50 tons K₂O; 6 per cent on 100 tons;
7 per cent on 300 tons; 10 per cent on
500 tons. Prices guaranteed against
sellers' decline until April 30, 1926.
Heavy volume of business booked this
season.

Pumice Stone—In barrels, per lb.,
powdered, 2½@5c.; selected lumps,
6@7c.; lumps in bags, 4@6c.

Pyrites—Tharsis, per long ton unit of
sulphur, c.i.f. U. S. ports: furnace size,
13½c. Cinder from ore to remain prop-
erty of buyers. Market poor, only
Coast plants being served. Brimstone
at \$20, c.i.f., is helping and inquiries
are in increased volume.

Quartz Rock Crystals—Colorless,
clear and flawed, pieces ¼ to ½ lb. in
weight, 40c. per lb. in ton lots. For
optical purposes, double above prices.

Rutile—*Virginia*, per lb.; granular,
94@96 per cent TiO₂, 12@15c.; pulver-
ized, 100 mesh, 94@96 per cent, 17@
30c.

Florida 93 per cent TiO₂, \$200 per
ton.

Silica—Water ground and floated, per
ton f.o.b. *Illinois*: 450 mesh, \$31; 250
mesh, \$22.

Glass sand, \$1@5 per ton; brick and
molding sand, 30c.@2; blast sand,
\$2.50@4.50.

Spodumene—\$20@30 per ton, de-
pending upon lithium content. Nomi-
nal.

Sulphur—\$15@16 per ton for do-
mestic, f.o.b. *Texas* mines; \$20 for
export, f.a.s. *New York*. Sales of
1,800,000 tons against a production of
1,500,000 tons are estimated for 1926.

Talc—Per ton, carload lots, f.o.b.
works, containers included:

Vermont: 200 mesh, extra white, \$11;
180 mesh, medium white, \$10; packed
in 50-lb. paper bags. Demand good so
far this year with slight weakening in
October.

New York: Double air-floated, 100
mesh, \$11.25; 200 mesh, \$13.75; 325
mesh, \$14.75. Demand fair.

Georgia: Powdered, gray, \$7.50@10;
yellow, \$9@12; red, \$11@13; roofing,
\$7.50@9. Market fair.

New Jersey: Soapstone, ground,
\$10@12; market fair.

Tripoli—Per short ton, burlap bags,
paper liners, minimum carload 30 tons,
f.o.b. *Missouri*: Once ground through 40
mesh: rose and cream colored, \$20;
white, \$18@27. Double ground through
110 mesh: rose and cream, \$17@25;
white, \$19@30. Air-float through 200

Price furnished by Foote Mineral Co.,
Philadelphia.

mesh: rose and cream, \$35@40;
white, \$40; mill run, \$15. Usual active
seasonal business.

Zircon—Freight allowed east of Mis-
sissippi River:

99 per cent, 3c. per lb., f.o.b. *Florida*,
in carload lots.

Mineral Products

Arsenious Oxide (white arsenic)—
3.25c.@3.50c. per lb. delivered. A few
carloads sold. London £15 per long ton.
Market poor; price nominal.

Copper Sulphate—Large crystals,
4.45@4.75c. per lb.; small, 0.1c. less.

Sodium Nitrate—Spot, \$2.59@2.62
per 100 lb., ex vessel Atlantic ports.

Sodium Sulphate—90c.@1.30 per 100
lb., f.o.b. works, for Glauber's salt.

Zinc Oxide—Per lb. in bags: Lead
free, 7½c.; 35 per cent leaded grades,
8c.; French, 10½@12½c.

Ferro-Alloys

Ferrocium—\$7 per lb.

Ferrocrome—0.1 per cent carbon,
35c. per lb. of contained chromium; 2
per cent carbon, 23c. per lb.; 4 to 8 per
cent carbon 11½c. per lb.

Ferromanganese—Domestic and for-
eign, 78@82 per cent, \$115 per gross
ton. Spiegeleisen, 19@21 per cent,
\$33@34 f.o.b. furnace; 16@19 per
cent, \$32.

Ferrophosphorus—Electrolytic, 18 per
cent P, \$91 per ton; 24 per cent,
\$122.50; f.o.b. Ala. and Tenn.

Ferrosilicon—14 to 16 per cent, \$42
@\$47 per gross ton, f.o.b. works; 50 per
cent, \$85 delivered; 75 per cent, \$145.
Market active.

Ferrotitanium—For 15 to 18 per cent
material, \$200 per ton, f.o.b. Niagara
Falls, N. Y.

Ferrotungsten—\$1.10@1.15 per lb.
of contained W, f.o.b. works, according
to grade.

Ferro-uranium—30 to 40 per cent U,
\$4.50 per lb. of U contained, f.o.b.
works in 500-lb. lots.

Ferrovandium—Per lb. of V con-
tained, f.o.b. works, \$3.50@\$4.

Metal Products

Rolled Copper—Sheets, 22½c.; wire,
16½c.

Lead Sheets—Rolled, 13½c.; clipped,
13½c.

Nickel Silver—29½c. per lb. for 18
per cent nickel Grade A sheets.

Yellow (Muntz) Metal—Dimension
sheets, 20½c. per lb.; rods, 17½c. per lb.

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

Refractories

Chrome Brick—\$45@\$48 per net ton,
f.o.b. shipping point.

Firebrick—First quality, \$43@\$46 per
M., Ohio, Kentucky, Central Pennsyl-
vania; second quality, \$35@\$40.

Magnesite Brick—9-in. straights, \$65
per net ton, f.o.b. works.

Silica Brick—\$40 per M. Penn-
sylvania and Ohio, \$48@\$52 Alabama.

Zirkite—Powdered, 80 per cent ZrO₂,
2½c. per lb. Brick, straights, 80c.@1
each.

Metal Statistics

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1924	1925	1924	1925	1924	1925
January	63.447	68.447	33.549	32.197	425.524	477.702
February	64.359	68.472	33.565	32.245	430.457	476.886
March	63.957	67.808	33.483	31.935	428.769	477.279
April	64.139	66.899	33.065	31.372	434.788	479.034
May	65.524	67.580	33.870	31.276	435.716	484.960
June	66.690	69.106	34.758	31.863	431.675	485.553
July	67.159	69.442	34.509	31.954	436.649	485.514
August	68.519	70.240	34.213	32.268	449.510	485.264
September	69.350	71.570	34.832	32.983	445.740	484.270
October	70.827	71.106	35.387	32.972	448.274	483.909
November	69.299	69.223	33.775	32.155	460.543	484.201
December	68.096	.....	32.620	.....	469.115	.....
Year	66.781	.....	33.969	.....	441.397	.....

New York quotations, cents per ounce troy, 999 fine, foreign silver. London pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic		London Standard		London Electrolytic	
	1924	1925	1924	1925	1924	1925
January	12.401	14.709	61.273	66.065	67.193	70.607
February	12.708	14.463	63.113	64.713	68.167	69.525
March	13.515	14.004	66.137	62.892	72.087	67.739
April	13.206	13.252	64.338	60.575	70.150	64.194
May	12.772	13.347	62.006	60.131	67.648	63.569
June	12.327	13.399	61.375	59.899	56.313	63.349
July	12.390	13.946	61.652	61.467	65.815	65.750
August	13.221	14.490	63.481	62.613	67.800	68.169
September	12.917	14.376	62.750	61.886	67.125	67.693
October	12.933	14.300	62.641	61.977	66.620	67.523
November	13.635	14.353	63.731	61.280	68.063	67.893
December	14.260	.....	65.295	.....	69.762	.....
Year	13.024	.....	63.149	.....	68.062	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London	
	1924	1925	1924	1925	1924	1925
January	7.972	10.169	8.002	9.953	31.528	41.443
February	8.554	9.428	8.643	9.126	34.589	37.944
March	9.013	8.914	8.891	8.578	37.161	36.804
April	8.263	8.005	7.932	7.662	32.819	32.791
May	7.269	7.985	6.973	7.780	29.426	32.283
June	7.020	8.321	6.948	8.024	32.138	33.479
July	7.117	8.151	6.886	8.054	32.916	34.698
August	7.827	9.192	7.764	9.284	32.728	38.188
September	8.000	9.508	7.876	9.303	33.023	38.884
October	8.235	9.513	8.118	9.299	35.715	39.017
November	8.689	9.739	8.590	9.578	39.425	36.872
December	9.207	.....	9.106	.....	41.583	.....
Year	8.097	.....	7.969	.....	34.421	.....

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

Tin

	New York 99%		Straits		London	
	1924	1925	1924	1925	1924	1925
January	48.250	57.692	48.750	58.250	246.790	265.560
February	52.772	56.517	53.272	57.068	272.399	262.181
March	54.373	53.038	54.870	53.733	277.429	245.682
April	49.457	51.380	49.957	52.135	250.863	237.006
May	43.611	53.675	44.111	54.620	218.511	245.476
June	42.265	54.885	42.765	55.957	219.219	252.476
July	45.750	56.683	46.250	58.014	233.332	258.435
August	51.409	56.649	51.909	58.190	254.638	258.538
September	48.595	56.405	49.095	58.247	243.511	259.182
October	50.038	60.462	50.538	62.274	248.543	277.722
November	53.848	62.136	54.348	63.304	257.738	284.506
December	55.721	.....	56.245	.....	261.875	.....
Year	49.674	.....	50.175	.....	248.737	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Zinc

	St. Louis		London	
	1924	1925	1924	1925
January	6.426	7.738	34.761	37.917
February	6.756	7.480	36.518	36.528
March	6.488	7.319	35.298	35.741
April	6.121	6.985	32.588	34.644
May	5.793	6.551	30.648	34.223
June	5.792	6.990	31.788	34.149
July	5.898	7.206	32.193	34.894
August	6.175	7.576	32.544	36.691
September	6.181	7.753	32.926	37.435
October	6.324	8.282	33.514	39.884
November	6.796	8.614	35.022	39.039
December	7.374	.....	36.932	.....
Year	6.344	.....	33.728	.....

St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a)		Quicksilver (b)		Platinum (c)		Crude
	New York 1924	New York 1925	New York 1924	New York 1925	Refined 1924	New York 1925	
January	10.279	17.428	59.500	81.596	122.115	117.000	111.663
February	10.935	19.795	59.565	79.386	124.739	117.000	114.216
March	11.442	15.553	64.269	80.481	121.692	117.000	115.000
April	9.952	12.553	74.308	82.327	115.577	118.269	114.769
May	8.755	15.770	76.962	81.360	115.731	119.850	115.000
June	8.403	16.500	73.720	83.154	116.000	120.000	115.000
July	8.477	17.779	72.173	83.077	118.231	120.000	114.346
August	9.839	17.683	72.096	82.317	120.000	120.000	113.538
September	11.022	17.143	72.423	81.730	118.923	120.000	113.710
October	11.519	18.029	70.654	83.856	118.000	120.000	113.918
November	14.385	20.000	68.708	88.250	117.792	120.000	114.000
December	15.024	.....	72.750	.....	117.000	.....	.....
Year	10.836	.....	69.761	.....	118.817	.....	.....

(a) Antimony quotations in cents per pound for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1924	1925	1924	1925	1924	1925
January	24.76	24.66	23.76	23.76	23.88	23.76
February	25.26	24.50	23.76	23.26	25.06	23.76
March	25.14	24.06	23.76	23.06	24.76	22.91
April	24.56	22.89	23.26	21.76	23.80	22.26
May	23.89	21.57	22.08	20.26	22.91	21.16
June	22.90	20.76	21.49	19.76	21.48	20.11
July	21.90	20.76	20.76	19.76	20.76	20.26
August	21.76	20.76	20.76	19.76	20.99	19.26
September	21.76	21.04	20.76	20.03	21.68	20.50
October	21.76	21.50	20.26	20.37	21.26	20.83
November	22.08	22.64	21.44	21.58	21.17	22.08
December	23.65	.....	22.04	.....	22.86	.....
Year	23.28	.....	22.01	.....	22.55	.....

In dollars per long ton.

Monthly Crude Copper Output in Short Tons

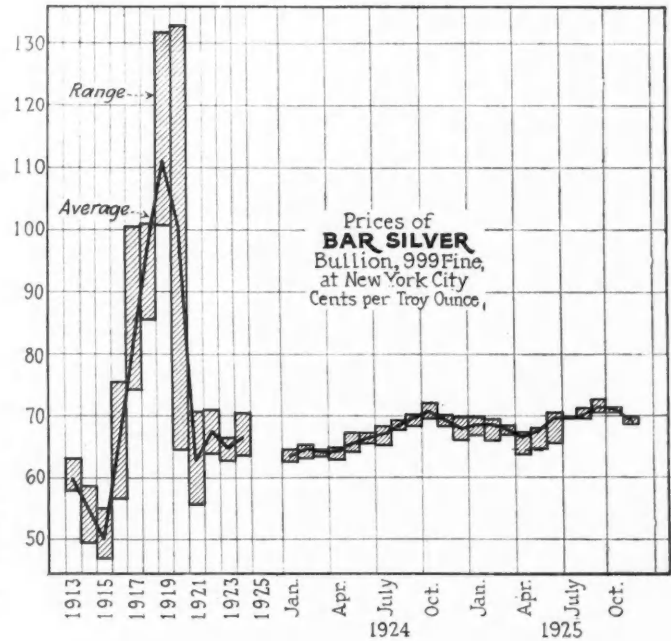
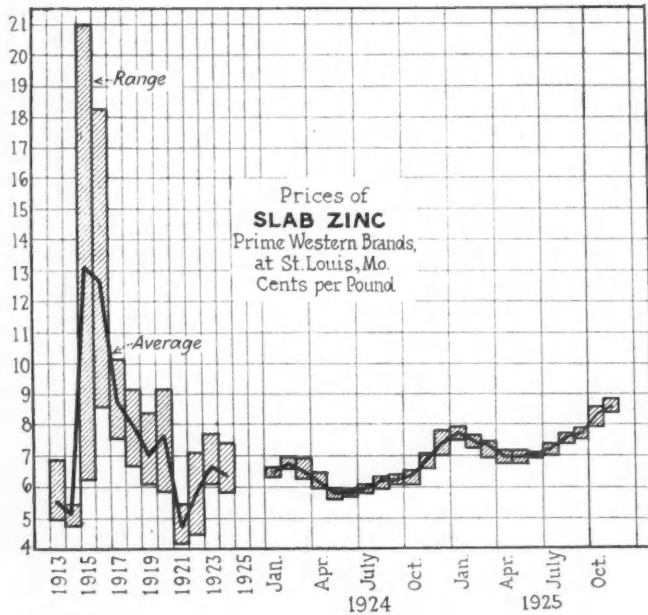
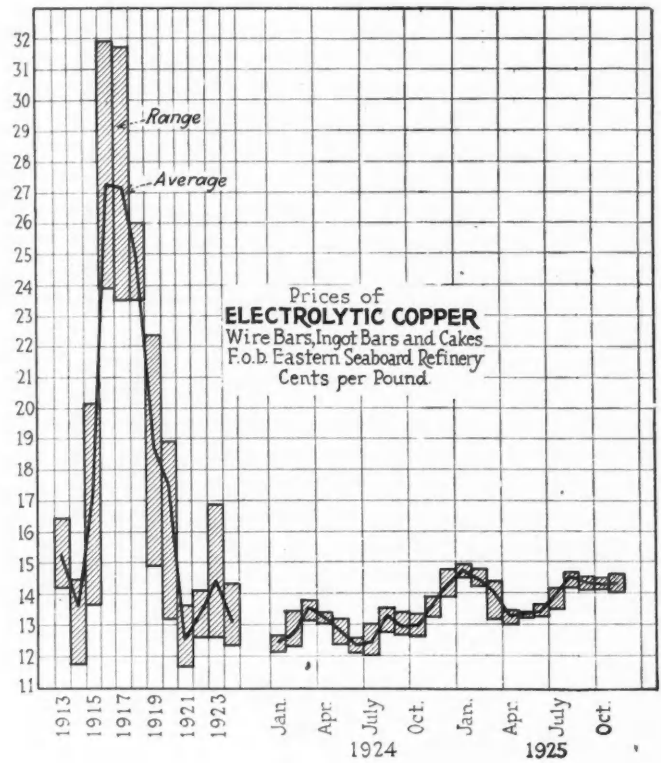
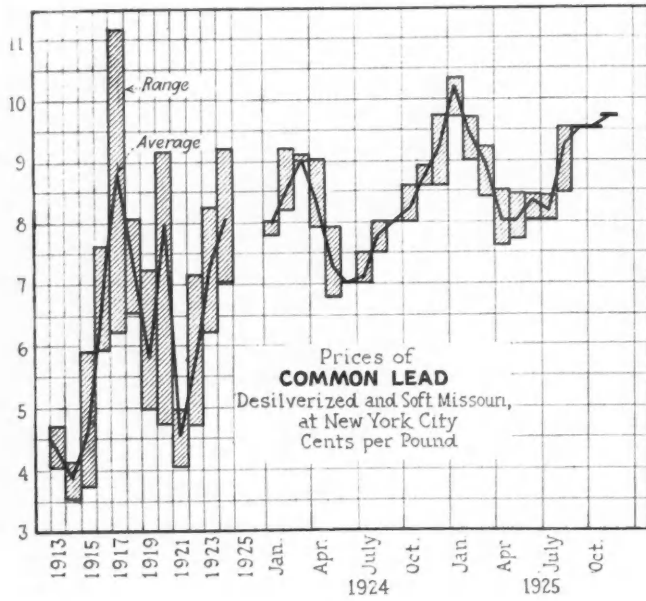
	Domestic					
	May	June	July	Aug.	Sept.	Oct.
Alaska shipments	2,877	2,848	3,643	67	5,496	3,140
Calumet & Arizona	2,205	1,924	1,876	1,970	.....	.....
Miami	2,209	2,190	1,861	2,350	2,088	2,052
New Cornelia	3,346	3,115	2,834	2,460	.....	.....
Old Dominion	1,418	1,381	1,120	1,030	1,371	1,097
P Phelps Dodge	7,054	7,214	6,878	6,600	6,748	6,636
United Verde Extension	1,812	1,565	1,931	1,928	1,865	1,797
Tennessee Copper	.....	.....	549	610	.....	.....
Imports: Ore and concentrates, matte	12,638	6,898	5,261	6,485	4,340	5,970
Imports of black and blister, unrefined	15,706	26,349	16,796	23,309	16,815	14,990
Imports of refined and old	4,386	7,298	2,461	4,348	5,440	4,678
Foreign	.....	847	791	832	858	854
Falcon Mines, Rhodesia	.....	.....	211	.....	.....	.....
Furukawa, Japan	1,315	1,390	1,615	1,409	1,575	.....
Granby Cons., Canada	1,765	1,653	1,620	1,669	1,495	1,738
Katanga, Africa	8,998	9,415	9,045	10,165	8,284	8,703
Mount Morgan, Aust.	499	403	415	.....	.....	.....
Mount Lyell, Aust.	.....	2,021(a)	.....	.....	.....	.....
Phelps Dodge, Mexican	1,573	1,764	1,982	2,118	1,963	1,822
Sumitomo, Japan	569	1,412	1,570	1,691	1,011	.....

(a) Three months.

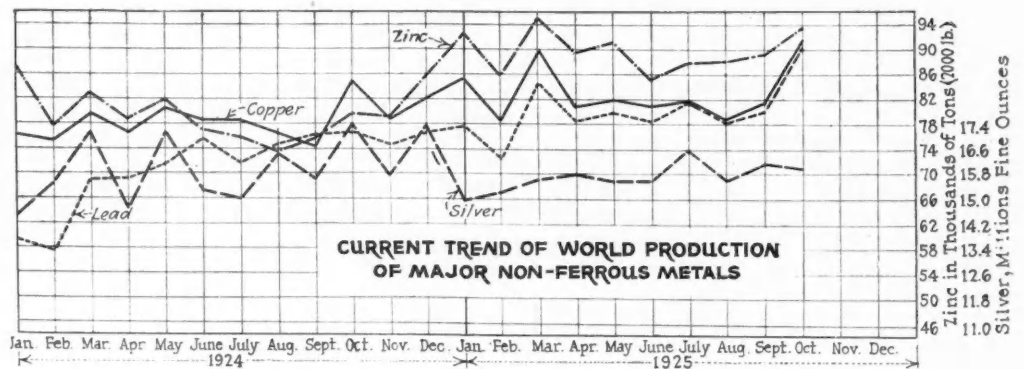
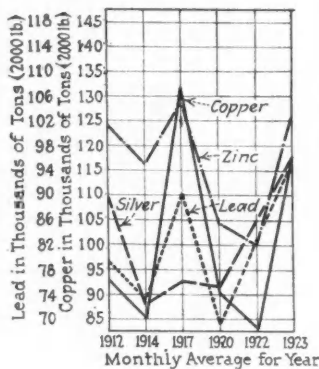
Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

	1923		1924		1925	
	Monthly Production	Daily Rate	Monthly Production	Daily Rate	Monthly Production	Daily Rate
January	56,134	1,811	66,631	2,149	74,789	2,412
February	51,368	1,834	65,681	2,205	68,967	2,463
March	60,781	1,961	65,181	2,103	74,901	2,416
April	59,078	1,969	66,073	2,202	70,667	2,356
May	62,718	2,023	65,608	2,116	70,574	2,276
June	62,740	2,091	63,933	2,131	69,894	2,330
July	63,071	2,034	64,787	2,090	68,507	2,210
August	65,865	2,125	66,756	2,153	68,090	2,196
September	62,255	2,075	63,800	2,127	67,720	2,272
October	66,035	2,130	68,989	2,225	70,624	2,278
November	63,885	2,129	68,291	2,276	.....	.....
December	64,832	2,091	67,647	2,182	.....	.....
Total	738,763	.....	793,377	.....	704,733	.....
Monthly average	61,564	.....	66,115	.....	70,473	.....
Average of daily rate	.....	2,024	.....	2,168	.....	2,318

Metal Price Curves



THE curves below are not to be considered as permanent records of production. They show merely the current trend according to latest estimates of the American Bureau of Metal Statistics. The figure for copper represents reports from countries producing about 97 per cent of the world's total in 1923 and 1924, to which is added an estimate for the remaining 3 per cent. Countries that in 1923 and 1924 produced 78.5 per cent of the lead, 87.5 per cent of the zinc, and 81 per cent of the silver are represented in the respective curves, with no estimate for non-reporting countries.



Imports and Exports of Ores and Metals in October, 1924 and 1925

Compiled by the U. S. Department of Commerce

In pounds unless otherwise specified

Imports		Exports of Copper, Lead and Zinc	
	October, 1924	October, 1925	
Antimony			
Ore	61,689	389,719	
Liquated, regulus, or metal	744,755	2,508,692	
Copper			
Ores	1,798,794	7,030,968	
Concentrates	2,288,220	4,822,679	
Regulus, coarse metal, cement copper	40,972	87,677	
Imported from			
Spain	575,582	248,600	
Canada	555,000	3,697,515	
Mexico	2,098,060	1,872,250	
Cuba		6,106,446	
Chile	258,732	1,829,486	
Colombia	2,526		
Peru	137,233	110,273	
Other countries	500,853	76,754	
Unrefined, black, blister, and converted copper in pigs, bars and other forms	33,852,068	29,980,953	
From			
United Kingdom	625,611	4,596,749	
Canada	1,614,186	8,551,896	
Mexico	4,421,514	2,540,528	
Chile	6,863,776	7,944,967	
Peru	4,235,962	6,346,813	
Portuguese Africa	15,413,634	677,385	
Other countries	677,385	8,093,083	
Refined copper	6,807,557	1,264,945	
Old and clippings for remanufacture	234,693		
Composition metal, copper chief value			
Copper manufactures	13,556	39,939	
Brass			
Old and clippings for remanufacture	401,184	957,515	
Manufactures of brass	113,858	185,281	
Lead			
Ore and matte	7,569,841	8,176,205	
Bullion or base bullion	11,921,933	7,578,137	
Pigs, bars, other forms, and old	135,561		
Manufactures of, except type metal	198,230	163,958	
Manganese ore, long tons	8,709	22,926	
Pyrites, long tons	16,357	7,700	
Tin			
Tin ore, tons	33	14	
In blocks, bars, and pigs	10,070,127	14,337,268	
From			
United Kingdom	1,513,419	3,864,745	
British Straits Settlements	7,604,526	9,460,411	
Hongkong	33,461	168,253	
Australia	134,400	87,600	
Other countries	784,321	754,259	
Zinc			
Ore, free			
Dutiable	2,171,700	7,738,635	
Blocks, pigs, and other forms	10,064		
Zinc dust	7,500	15,123	
Copper			
Ores, concentrates, matte, and regulus	1,587	72,214	
Copper and manufactures of	93,522,525	63,548,277	
Refined in ingots, bars, and other forms	83,509,744	55,370,977	
Exported to			
Belgium	8,622,981	5,707,872	
France	15,928,700	10,000,000	
Germany	19,562,569	12,240,108	
Italy	8,816,068	4,562,397	
Netherlands	6,515,447	3,297,611	
Spain	268,576	45,063	
Sweden	3,219,775	1,596,731	
United Kingdom	14,787,359	14,191,341	
Canada	2,561,644	1,692,961	
China	2,033,920	57,050	
Japan	223,946	1,119,920	
Other countries	968,759	859,923	
Old and scrap copper	320,130	254,599	
Pipes and tubes	270,425	234,354	
Plates and sheets	1,004,838	432,959	
Rods	4,837,423	4,322,946	
Wire	1,112,844	1,127,752	
Insulated copper wire and cable	1,959,594	1,205,806	
Other manufactures of copper	507,527	598,884	
Lead			
Pigs, bars, and other forms			
From domestic ore	1,173,484	249,489	
From foreign ore	12,095,938	9,751,576	
Exported to			
France	784,193	560,083	
Germany	1,949,248	2,296,671	
Netherlands	257,223	896,258	
United Kingdom	7,663,671	4,649,243	
Other Europe	1,120,446	560,212	
Argentina	738,653	238,589	
Brazil	112,022	224,101	
Japan	448,000	448,052	
Other countries	195,966	137,856	
Other lead manufactures	2,349,009	1,347,998	
Zinc			
Dross		5,757,190	
Ores and concentrates	1,171	12,363	
Zinc (spelter) in slabs, blocks or pigs	12,195,237	13,688,078	
Exported to			
Belgium	112,044	560,064	
France	2,183,641	616,148	
Germany		769,726	
Italy	1,332,304	1,075,455	
United Kingdom	7,823,717	9,624,633	
Other Europe	330	481,588	
Canada	213,439	200,038	
Other countries	529,562	360,426	
In sheets, strips, and other forms	425,815	518,675	
Zinc dust	377,366	629,880	
Other zinc manufactures	56,343	307,512	

Utah Copper Co.

Report of the Utah Copper Co. for the third quarter of the year 1925 shows a total net production of copper from all sources, in comparison with the output for the first and second quarterly periods of 1925, as follows:

	Net Pounds Copper Produced	Average Monthly Production
Quarter ended March 31	53,708,682	17,902,894
Quarter ended June 30	53,409,289	17,803,096
Quarter ended Sept. 30	53,597,545	17,865,848

During the quarter the Arthur plant treated 1,507,600 dry tons of ore and the Magna plant 1,720,700 dry tons, a total for both plants of 3,228,300. The average grade of ore treated at the mills was 0.99 per cent copper and the average mill recovery of copper in the form of concentrates was 86.76 per cent of that contained in the ore.

The average cost per pound of net copper produced, including depreciation of plant and equipment and all fixed and general expenses and after crediting gold, silver and miscellaneous earnings, was 8.7c., compared with 8.4c. for the preceding quarter, computed on the same basis.

The following tabulation shows the financial results of the company's operations for the quarter, as compared with the two previous quarters:

	Third Quarter 1925	Second Quarter 1925
Net profit from copper production	\$2,457,806.78	\$2,343,443.41
Miscellaneous income, including gold and silver	664,667.96	707,178.09
Bingham & Garfield Railway Co. dividend	75,000.00	75,000.00
Total income	\$3,197,474.74	\$3,125,621.50
Depreciation	302,802.21	298,569.61
To surplus	\$2,894,672.53	\$2,827,051.89

Earnings for the third quarter are computed on the basis of 13.95c. per pound carrying price for copper, as compared with 13.53c. for the second quarter.

The total capping removed during the quarter was 1,978,018 cu.yd., compared with 2,245,347 cu.yd. for the previous quarter. The ore-delivery department transported a total of 3,376,503 tons of ore, being an average of 36,701 tons per diem, as compared with 3,257,935 tons total and 35,801 tons daily average for the previous quarter.

Hecla Mining Co.

Silver, Lead; Idaho

The Hecla Mining Co. reports the following results of operations for the second and third quarters of the year:

	Second Quarter		Third Quarter	
Gross income		\$934,914.05		\$1,252,182.43
Operating expenses	\$372,153.40		\$378,131.47	
Taxes accrued	54,000.00		97,000.00	
Depreciation (estimated)	40,467.89		48,853.26	
Total expenses		466,621.29		523,984.73
Net profit		\$468,292.76		\$728,197.70
Tons mined		77,343		86,062
Pounds lead produced		12,361,720		14,260,336
Average lead price		\$8.14		\$9.38
Ounces silver produced		345,910		407,601
Average silver price		\$0.69		\$0.71

Transvaal Gold Output Is Steady

The Transvaal gold output for October, 1925, amounted to 812,822 oz., compared with 797,247 oz. for September, 1925, and 827,583 oz. for October, 1924.

Mining Stocks—Week Ended November 28, 1925

Stock	Exch.	High	Low	Last	Last Div.	Stock	Exch.	High	Low	Last	Last Div.		
COPPER						SILVER							
Anaconda	New York	49 1/4	47 1/4	49 1/4	Oct. 17, No. 23 Q	0.75	Alvarado	N. Y. Curb			*76	Oct., 1920	0.50
Arcadian Consol.	Boston	*95	*90	*90			Beaver Consol.	Toronto	*51	*50 1/2	*50 1/2	May, 1920	0.03
Ariz. Com'l.	Boston	13 1/2	13	13	Jy. 21, Jy. 31 SA	0.50	Castle-Trethewey	Toronto	1.40	1.36	1.38		
Calaveras	N. Y. Curb	4 1/2	4	4			Coniagas	Toronto	3.20	2.70	3.05	May, 1924	0.12 1/2
Calumet & Arizona	New York	58 1/2	56 1/2	58	De. 4, De. 21 QX	1.50	Keeley	Toronto	1.45	1.43	1.44	Au. 31, Se. 15RX	0.12
Calumet & Hecla	Boston	15 1/2	15 1/2	15 1/2	Nov. 30, De. 15 Q	0.50	Kerr Lake	N. Y. Curb	1 1/2	1 1/2	1 1/2	Oct. 1, Oc. 15 Q	0.12 1/2
Cerro de Pasco	New York	61 1/2	58 1/2	60 1/2	Oct. 22, Nov. 2 Q	1.00	La Rose	Toronto	*35	*32	*33 1/2	Apr., 1922	0.10 1/2
Chile Copper	New York	35 1/2	34 1/2	34 1/2	Dec. 2, Dec. 28, Q	0.62 1/2	Lorrain Trout Lake	Toronto	*80	*80	*80	Jy. 2, Jy. 15	0.05
Chino	New York	20 1/2	20	20	Sept., 1920	0.37 1/2	McKinley-Dar-Sav.	Toronto	*18 1/2	*17	*18	Oct., 1920	0.03
Con. Coppermines	N. Y. Curb	2 1/2	2	2			Mining Corp. Can.	Toronto	3.08	3.03	3.06	Jy. 1, Jy. 15	0.12 1/2
Copper Range	Boston	20 1/2	19 1/2	20	Ap. 9, My. 4	1.00	Nipissing	N. Y. Curb	5 1/2	4 1/2	5 1/2	Se. 30, Oc. 20, Q	0.15
Crystal Copper	Boston Curb	*58	*51	*54			Ontario Silver	New York	10 1/2	10 1/2	10 1/2	Jan., 1919	0.50
East Butte	Boston	4 1/2	3 1/2	3 1/2	Dec., 1919	0.15	Temiskaming	Toronto	*12 1/2	*12	*12	Jan., 1920	0.40
First National	Boston Curb	*22	*15	*1	Feb., 1919	0.15	SILVER-LEAD						
Franklin	Boston	19	18	18 1/2	May, 1919	1.25	Ahumada	New York	9 1/2	9	9 1/2	De. 15, Ja. 2, QX	0.25
Granby Consol.	New York	13 1/2	13	13	Nov., 1920	0.50	Bingham Mines	Boston	55	54	55	De. 19, De. 20 Q	1.00
Greene-Cananea	New York	13 1/2	13	13			Cardiff M. & M.	Salt Lake	*63	*55	*63	De. 16, No. 18	0.10
Hancock	Boston	*50	*50	*50			Chief Consol.	Salt Lake	3.90	3.90	3.90	Oct. 10, No. 1	0.10
HoweSound new r. t. c.	New York	25 1/2	24 1/2	24 1/2	Oct. 5, Oc. 15 Q	0.50	Columbus Rexall	Salt Lake	1.25	1.25	1.25	Aug., 1923	0.05
Inspiration Consol.	New York	26 1/2	26	26 1/2	De. 17, Ja. 4, Q	0.50	Erupicon	Boston Curb	3 1/2	2 3/4	2 3/4	Se. 19, Oc. 2, QEX	0.15
Iron Cap	Boston Curb	2 1/2	2 1/2	2 1/2	May, 1923	0.15	Federal M. & S.	New York	86	66 1/2	71	No. 25, De. 15 Q	1.75
Isle Royale	Boston	13 1/2	12 1/2	13 1/2	No. 30, De. 5	1.00	Federal M. & S., pfd.	New York	93 1/2	86	86	Au. 25, Se. 15	1.75
Jerome Verde Dev.	N. Y. Curb	1 1/2	1	1			Hecla Mining	N. Y. Curb	17 1/2	17 1/2	17 1/2	No. 15, De. 15 Q	2.00
Kennecott	New York	56 1/2	55 1/2	55 1/2	De. 4, Jan. 2 Q	1.00	Iron Blossom Con.	Salt Lake	5 1/2	5 1/2	5 1/2	Oct. 25, 1924	0.01 1/2
Lake Copper	Boston	4 1/2	4 1/2	4 1/2	Jn. 1, Jn. 15 Q	0.50	Iron King Mining	Salt Lake	*48 1/2	*46	*47		
Magma Copper	New York	44 1/2	42 1/2	43 1/2	Oct. 1, Oct. 15, Q	0.75	Keystone Mining	Salt Lake	*68	*67	*67	Au. 12, Au. 26	0.07 1/2
Mason Valley	N. Y. Curb	1 1/2	1 1/2	1 1/2			Lucky Jim	Spokane	13 1/2	13	13		
Mass Consolidated	Boston	*50	*50	*50	Nov., 1917	1.00	Mammoth Mining	Salt Lake	3.00	2.97 1/2	3.00	My. 15, My. 25	0.10
Miami Copper	New York	11 1/2	10 1/2	11	No. 2, No. 16 Q	0.25	Marsh Mines	Spokane	*8 1/2	*7 1/2	*7 1/2	Se. 15, Oc. 1	0.15
Mohawk	Boston	33 1/2	32 1/2	33 1/2	Oct. 31, De. 2	1.00	Park Utah	Salt Lake	8.25	7.90	7.90	Se. 15, Oc. 1	0.15
Mother Lode Coa.	New York	14 1/2	13 1/2	13 1/2	De. 11, De. 31	0.37 1/2	Prince Consol.	Salt Lake	*11 1/2	*10	*10		
Nevada Consol.	New York	14	13 1/2	13 1/2	Sept., 1920	0.25	Silver King Coal	Salt Lake			10.12 1/2	De. 15, Ja. 2, QX	0.35
New Cornelia	Boston	20	19 1/2	19 1/2	No. 6, No. 23 Q	0.25	Silver Smith	Spokane	*34 1/2	*32	*34	Oc. 1, Oc. 10	0.01
North Butte	Boston	3 1/2	3 1/2	3 1/2	Oct., 1918	0.25	Tamarack-Custer	Spokane	*35	*32	*32	Sept., 1924	0.25
Ohio Copper	N. Y. Curb	*80	*76	*80	No. 14, De. 2	0.05	Tintic Standard	Salt Lake	14.50	14.50	14.50	Se. 22, Se. 29	0.40
Old Dominion	Boston	19 1/2	18 1/2	18 1/2	Dec., 1918	1.00	Utah-Apex	Boston	6 1/2	5 1/2	6	Oc. 3, Oc. 15, Q	0.35
Phelps Dodge	Open Mar.	†130	†125	†125	Se. 19, Oc. 2 Q	1.00	Western Utah Copper	N. Y. Curb			*10		
Quincy	Boston	23	22	23	Mar., 1920	1.00	IRON						
Ray Consolidated	New York	13 1/2	12 1/2	12 1/2	Dec., 1920	0.25	Bethlehem Steel	New York	48 1/2	45 1/2	47 1/2	July, 1924	1.25
Ray Hercules	N. Y. Curb	14	14	14			Colorado Fuel & Iron	New York	37	35 1/2	37	May, 1921	0.75
St. Mary's Min. Ld.	Boston	37 1/2	35	35 1/2	Ap. 20, My. 20	3.00	Gt. North'n Iron Ore	New York	27 1/2	26	27 1/2	De. 4, De. 28	0.75
Seneca Copper	Boston	9 1/2	9	9			Inland Steel	New York	44 1/2	43 1/2	44	No. 13, De. 1 Q	0.62 1/2
Shannon	Boston	*60	*60	*60	Nov., 1917	0.25	Mesabi Iron	N. Y. Curb	2	1 1/2	1 1/2		
Shattuck Arizona	New York	6	6	6	Jan., 1920	0.25	Replogle Steel	New York	15 1/2	14 1/2	15 1/2		
Superior & Boston	Boston	1 1/2	1	1			Republic I. & S.	New York	58 1/2	52 1/2	57 1/2	May, 1921	1.50
Tenn. C. & C.	New York	14	12 1/2	14	De. 31, Ja. 15 Q	0.25	Republic I. & S., pfd.	New York	93 1/2	93	93 1/2	De. 15, Ja. 2, Q	1.75
United Verde Ex.	N. Y. Curb	26	26	26	Oc. 6, Nov. 20	0.75	Sloss-Sheffield S. & I.	New York	140	112 1/2	132 1/2	De. 10, De. 21 Q	1.50
Utah Copper	New York			111	Se. 18, Se. 30, Q	1.00	Sloss-Shef. S. & I. pfd.	New York			102 1/2	De. 21, Ja. 2, Q	1.75
Utah Metal & T.	Boston	*62	*53	*62	Dec., 1917	0.30	U. S. Steel	New York	131 1/2	126 1/2	129 1/2	No. 28, De. 30 QX	1.75
Victoria	Boston	*25	*22	*25			U. S. Steel pfd.	New York	125 1/2	125	125 1/2	No. 3, No. 28, Q	1.75
Walker Mining	Salt Lake	1.85	1.82	1.82			Virginia I. C. & C.	New York	45	44	45	Jan., 1924	1.50
							Virginia I. C. & C. pfd.	New York			77	De. 15, Ja. 2	2.50
NICKEL-COPPER						ASBESTOS							
Internat. Nickel	New York	46 1/2	43 1/2	45 1/2	Se. 11, Se. 30, Q	0.50	Vanadium Corp.	New York	31 1/2	30 1/2	31	No. 2, No. 16 Q	0.50
Internat. Nickel, pfd.	New York	101	100 1/2	100 1/2	Oct. 15, No. 2, Q	1.50	SULPHUR						
LEAD						Asbestos Corp. Montreal 96 1/2 94 95 Se. 30, Oc. 15 Q 1.50							
Gladstone M. M. Co.	Spokane	*27 1/2	*26	*26	No. 1, No. 10 M	0.01	Asbestos Corp., pfd.	Montreal	116 1/2	115	115 1/2	Se. 30, Oc. 15, Q	1.50
National Lead	New York	165	162 1/2	164	De. 11, De. 31 Q	2.00	Freeport Texas	New York	19 1/2	17 1/2	19 1/2	Nov., 1919	1.00
St. Joseph Lead	New York	45	43 1/2	45	Aug. 21, Se. 15	1.75	Texas Gulf	New York	116	111 1/2	116	De. 1, De. 15, QX	2.75
ZINC						DIAMONDS							
Am. Z. L. & S.	New York	9 1/2	9 1/2	9 1/2	May., 1920	1.00	De Beers Consol.	New York			27 1/2	Jy. 27, Au. 30	0.97
Am. Z. L. & S., pfd.	New York	36 1/2	35 1/2	35	Nov., 1920	1.50	PLATINUM						
Butte C. & Z.	New York	7	6 1/2	6 1/2	De. 10, De. 24	0.50	So. Am. Gold & P.	N. Y. Curb	5 1/2	5 1/2	5 1/2		
Butte & Superior	New York	15 1/2	13 1/2	14 1/2	De. 9, De. 24	0.50	Mining, Smelting, Refining and General						
Callahan Zn-Ld.	New York	2 1/2	2	2	Dec., 1920	0.50	Amer. Metal	New York	53 1/2	51 1/2	53 1/2	No. 20, De. 1, Q	1.00
New Jersey Zn.	N. Y. Curb			21 1/2	No. 20, Dec. 10 X	2.00	Amer. Metal pfd.	New York	118	118	118	No. 21, De. 1, Q	1.75
United Zinc	N. Y. Curb			*35			Amer. Sm. & Ref.	New York	121 1/2	117 1/2	120 1/2	Oc. 16, No. 2, Q	1.75
Yellow Pine	Los Angeles			*45	Se. 10, Se. 21 Q	0.04	Amer. Sm. & Ref. pfd.	New York	113 1/2	112	112 1/2	No. 6, De. 1, Q	1.75
GOLD						MINING, SMELTING, REFINING AND GENERAL							
Alaska Juneau	New York	1 1/2	1 1/2	1 1/2			Consol. M. & S.	N. Y. Curb	154	144	152 1/2	Jn. 30, Jy. 15	0.75
Argonaut	Toronto	*16 1/2	*14	*16 1/2			Federated Metals	N. Y. Curb			25 1/2		
Barry-Hollinger	Toronto	*29 1/2	*26	*26 1/2			Newmont Mining	N. Y. Curb	45 1/2	44 1/2	45 1/2	Oc. 1, Oc. 15	0.60
Carson Hill	Boston	*30	*30	*30			Southwest Metals	N. Y. Curb	2 1/2	2 1/2	2 1/2		
Consol. W. Dome L.	Toronto	*16 1/2	*14 1/2	*16			U. S. Sm. R. & M.	New York	46	45	46	Oc. 7, Oc. 15, Q	0.75
Cresson Consol. G.	N. Y. Curb	2 1/2	2 1/2	2 1/2	Se. 30, Oc. 10	0.10	U. S. Sm. R. & M. pfd.	New York	47 1/2	47 1/2	47 1/2	Oc. 7, Oc. 15, Q	0.87 1/2
Crown Reserve	Toronto	*17	*16	*16 1/2	Jan., 1917	0.05	* 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.						
Dome Mines	New York	17 1/2	17 1/2	17 1/2	De. 31, Ja. 20, Q	0.50	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.						
Golden Cycle	Colo. Springs	17.10	16.70	16.90	Nov. 19, Dec. 2	0.08	LONDON QUOTATIONS, WEEK ENDED NOV. 21, 1925						
Hollinger Consol.	Toronto	48	48	48	No. 20, No. 25 M	0.50	Aramayo Mines (25 frs.)		81/10 1/2	78.9	80/—	Nov. 1925	5(c)
Homestake Mining	New York	*80 1/2	*76 1/2	*78			British Platinum		7/10 1/2	6/3	7/6	Feb. 1925	2 1/2
Kirkland Lake	Toronto	9.85	9.40	9.80	De. 1, De. 15 XQ	0.10	Burma Corp. (10 rupees)		19/6	18/—	19/—	Aug. 1925	6 annas.
Lake Shore	Toronto	22	21 1/2	21 1/2	No. 2, De. 1 Q	0.25	Bwana M'Kubwa		7/1 1/2	6/6	6/10 1/2		
McIntyre-Porcupine	New York	*22	*21 1/2	*24			Camp Bird		5/7 1/2	4/6	5/6		
Newray	Toronto	*35	*32 1/2	*34			El Oro		5/6	5/—	5/4 1/2	Nov. 1924	2 1/2*
Night Hawk Pen.	Toronto	*9	*7 1/2	*8			Esperanza		1/—	—/10 1/2	1/—		
Portland	Colo. Springs			*43	Oct., 1920	0.01	Frontino & Bolivia		9/9	8/9	8/9	July 1925	3 1/2
Rand Mines	New York	33 1/2	33 1/2	33 1/2	Au. 17, Au.								