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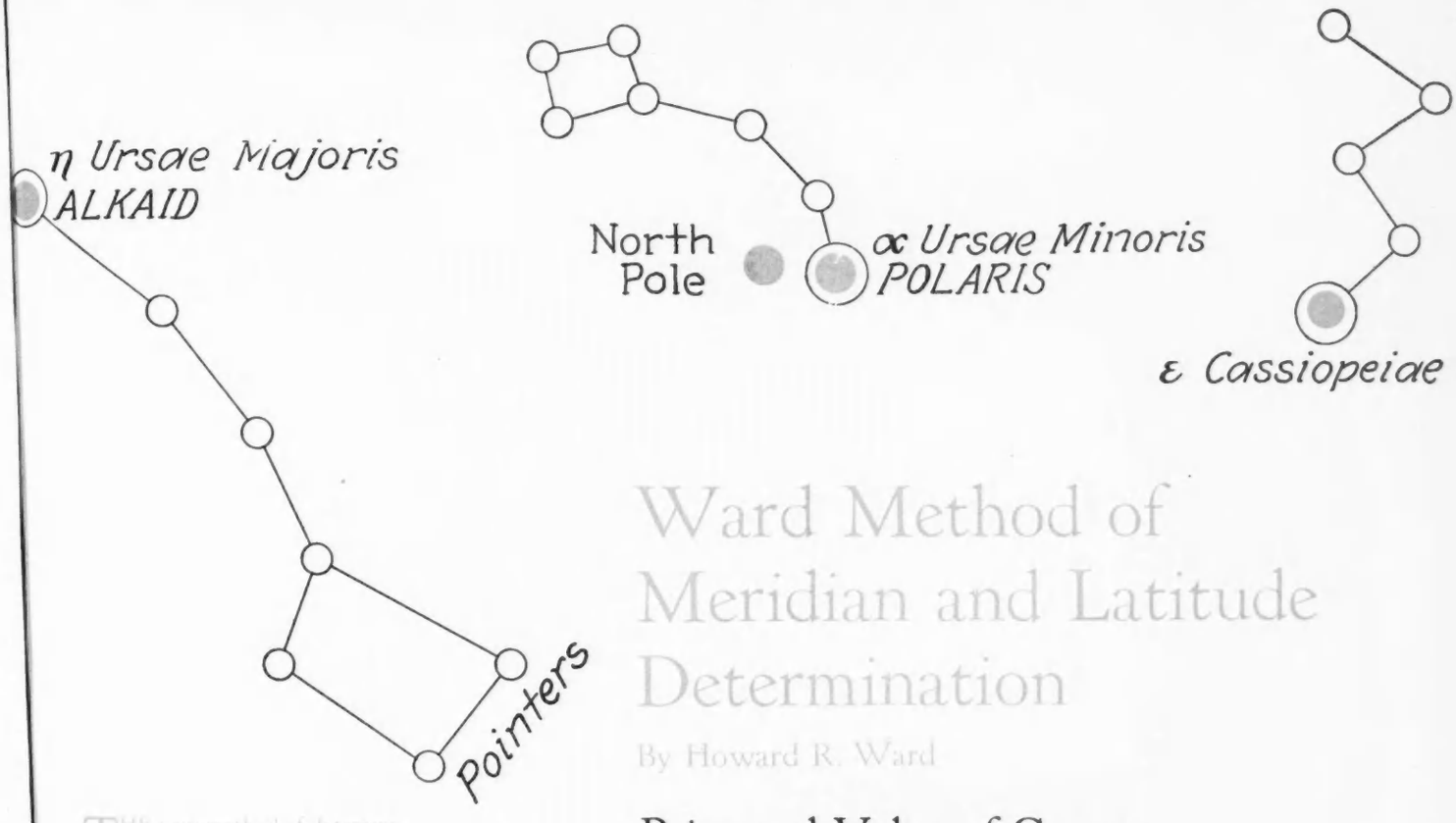


Ward Method of Meridian and Latitude Determination

By Howard R. Ward

THE new method of determining the meridian evolved by Howard R. Ward uses two stars near the pole, Polaris, and either Alkaid (of the Big Dipper) or ε Cassiopeiae. Observations may be made at almost any time of night when the stars are visible

Price and Value of Copper

By William Spence Black

The Miner and the Faulted Vein

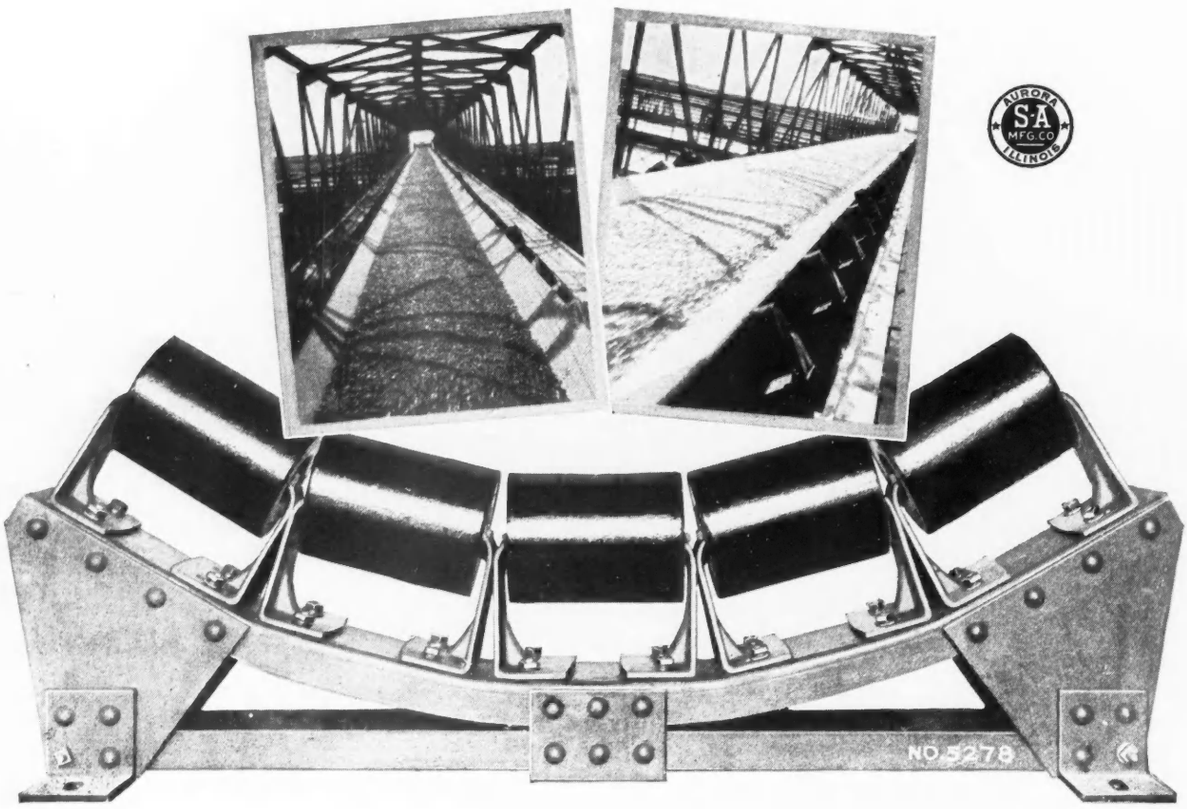
By C. W. Hall

Shall the Federal Government Finance Construction of Debris Dams?

By H. A. Finch

Gunite Construction in Honduras

By Samuel G. Lasky



Lengthening the life of conveyor belts

The Carriers upon which the belt travels, day after day, are of vital importance to the life of the belt. They must be strong enough to withstand hard knocks, rigid enough to stay in alignment, smooth enough to keep the belt from fraying, and they must offer the minimum of resistance to the travel of the belt.

S-A Unit Carriers are perfectly formed from steel tubing, presenting a smooth, even surface for belt contact and the ball bearings reduce the frictional wear on the belt to a negligible minimum.

The illustration above shows the S-A Triple-X All-Steel Unit Carrier, designed especially for heavy duty service under severe conditions. Where big, over-size ore must be handled in large quantities this carrier is ideally adapted. Like all S-A Carriers, these Units are practically indestructible.

Write us, our Engineering Department will be glad to make material handling suggestions.

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Ball bearing Units for Unit Carriers are now made in two styles—the well-known Unit with plain lubrication and the new Unit equipped for high-pressure lubrication.

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ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

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Investment Policies

ABOUT A YEAR AGO we pointed out editorially that the decrease in the purchasing power of the dollar had robbed the corporation or investor who had accumulated savings in the form of bonds, of a third or so of its or his surplus; and that this was also the case with those who had invested in mortgages or any other form of dollar investment. The remedy, we pointed out, might be to invest in real property, not in dollars—in real estate, or in the best type of common stocks, including, of course, mining stocks. This editorial, copied in *The Literary Digest* and elsewhere, attracted considerable attention, because of its somewhat novel viewpoint. Since then, however, this idea has spread, and today is somewhat the fashion.

Recently, a financial student has made comparisons of what would have been the result, over a term of years, in the past, if an investor had bought a diversified list of common stocks compared with a diversified list of bonds; and he surprised himself, as well as Wall Street, by discovering that in every test he applied, and over every term of years which he used, the common stock investment would have been far more remunerative. The reason for this is not only that the common stock is real property, while the bond is a mortgage and the preferred stock is in the nature of an unsecured and unmaturing note; it depends on the margin of safety in the form of surplus over dividends which any well-managed company leaves in the treasury yearly, and which continually enhances the value of the equity of the property (owned by the common stock holders).

Certain factors must not, however, be lost sight of in these generalizations. The first mortgage on a building is safer than the second mortgage or the equity; and the bonds of a corporation are accordingly safer than its stock. Better in some cases to get back a depreciated dollar in matured bonds than to lose the equity through the company going into depression or even a receivership. The common stock holder of the St. Paul railroad, of Wilson & Co., of the American Sumatra Tobacco Co. recently, in spite of having had a better chance, according to economic laws and averages, has unfortunately lost practically all his investment. Cases like these are so numerous that an investment expert of another school than the one we have been quoting warns against the danger of buying common stocks.

The test would seem to be in what bonds you buy and what stocks. And there is another complication in the appraisal of the future of the dollar. Although the dollar has gone on depreciating in value over many years, is that tendency sure to continue, confirming the wisdom of avoiding dollar investments? It is noticeable in the stock market that about the time the public is fully aware that stocks have consistently risen for a long time and have accordingly invested, prices begin to move downward.

Many economists believe that the purchasing value of the dollar will never substantially improve. That conviction solves one problem for them. On the other hand, if the world's supply of gold shall tend to become more and more inadequate for the transaction of the world's business, as seems likely to us, then the purchasing power of the dollar, over a considerable term of years, should gradually climb. A consideration of the waves in all natural forces, and even of the history of the purchasing power of gold over long periods in the past, warns one against concluding that because the dollar has declined in value for so long in the past it will do so for as long in the future.

And still another factor is to be found in the greater fluctuations in stocks as compared with bonds; and the fact that stocks in general are now at or approaching an apparent peak of high prices, from which point there seems nowhere to go, as a major movement, except downward.

Copper stocks have not moved upward so far as the general list, but there seem no natural economic reasons why they should do so. The world is producing more and more copper each year—increasing from about 955,000 tons in 1922 to 1,356,000 tons in 1923, and 1,520,000 tons in 1924; in 1925, according to a recent guess, it may be 1,625,000 to 1,650,000 tons. The copper market is therefore not suffering from lack of demand—nevertheless, the price of copper, owing to the abundant productive capacity, remains so low that the net returns on the capital invested are not satisfactory, nor have they been so since the war. There was on the average no profit in 1921; in 1922 profits were 2½c. a pound; they rose to 5c. in 1923, and shrunk to 4.29c. in 1924; and this low margin is in spite of very drastic cost reductions, so that the present average costs are around 9c., which in terms of the 1913 dollar would be only around 6c. compared with a pre-war cost of around 9½c. There is little evidence, on the whole, that the situation in copper is such that the price of copper stocks will move counter to the general list.

Improving Reverberatory Smelting

THE RECENT COURT DECISION upholding the Carson patents covering the side charging of copper ore and concentrate to reverberatory furnaces has caused many metallurgists in the United States to consider other ways of feeding their furnaces, by which they might escape paying the royalty fees. Before the ore was charged through the roof along the side walls, thereby protecting them from deterioration, it was the common practice to charge all of the ore directly in front of the burners or bridge wall, and to protect the side walls by fettling siliceous material by hand through doors in the walls. This practice was so far inferior to the now common method that metallurgists would hardly go back to it unless the royalties charged were out of all reason.

It has occurred to some that materials other than silica brick and siliceous ores might be used for the

side walls—magnesite, for instance. However, a magnesite bottom and magnesite brick in the side walls were tried by the Canadian Copper Co. about 1912, with but little success, according to William Kent, who was in charge of the furnace at that time. The magnesite brick cut out at the slag line about as badly as those made of silica. Chromite or zirconia have not, so far as we know, been tried, but even should they prove more adaptable to the purpose, a large sacrifice of metallurgical efficiency would be sustained.

Metallurgists should turn preferably to improving present practice rather than go back to or improve on the old. The only novelty that has been tried out in recent years, in the charging of reverberatories, is that devised by J. O. Ambler, first used at the Clifton smelter. The charge is introduced through horizontal holes in the side walls by mechanical means. In the last two or three years the Phelps Dodge metallurgists have carried on much further work based on this idea, and in January had one furnace fully equipped with screw feeders that had been operated for some months. The development of this method of charging has naturally presented several difficulties, not all of which have been solved, and about all that can be said so far is that the scheme has possibilities.

The imposition of a royalty for the old method of side charging will do much to spur the development of this and other proposed methods of charging, and it would not be strange if an improvement in methods should result that would be as far in advance of present practice as that covered by the Carson patents is in advance of the work that was done twenty years ago. Side feeding, better furnace and flue design, and better methods of firing have vastly increased the capacity of the reverberatory furnace. A 20x90-ft. furnace can now smelt 700 tons of ore a day with only 0.5 to 0.6 barrel of oil per ton of charge, but improvements can still be made, particularly in furnace losses and in reverberatory arch repairs. The finer grinding incidental to selective flotation processes has not been conducive to good furnace work, and improved methods of charging will be necessary to offset this, to the smelter, unfavorable development.

Economic Stimuli

IN A RECENT BOOK on "North America," by Prof. J. Russell Smith, we find crystallized some interesting observations on the effect of environment on history. For example, why was slavery an institution of the Southern United States and one opposed by the North? The answer given is that slaves did not pay in the North, on account of the long cold winters and poor soil. Slavery had as fair a start in Massachusetts as in Virginia, but soon disappeared in the North. In Washington's time slavery was a waning institution in the South. What revived it? The invention of the cotton gin. That made cotton growing and slave labor profitable throughout the South; the price of a slave consequently increased from $200 to $2,000; the South became prosperous thereby and a line of cleavage was begun between it and the North, which was only cleared up by the bloodiest war in our history.

In a similar way the distribution of minerals and the history of mining will be found to be tied up to and responsible for popular migrations, commercial prosperity, wars, and changes of government.

Idaho's Vigilant Mine Inspector

IN SOME STATES "blue-sky" legislation is drastic in its curb on the crooked mine promoter; in others the "blue-sky" laws are mild. Idaho, as we noted recently, has now a law on its books requiring the mine promoter to supply the state with copies of all advertising literature distributed by him. Certainly, that is not a very strict ruling. Yet at least one new flotation in the mining field has failed to live up to this law. Fortunately for the state, Idaho possesses an active Mine Inspector, in the person of Stewart Campbell, who is trying to make Idaho poor soil for the cultivation of the fishy mining venture. Lately, Mr. Campbell came upon the track of a company known as the Idaho Copper Corporation, listed on the Boston Curb, which has not lived up to the laws of his state with respect to the filing of its articles of incorporation nor with regard to the new law mentioned above. Furthermore, as Mr. Campbell discovered, the property of the Idaho Copper Corporation has not been worked for twenty-four years, with the exception of one brief lease; the underground workings are almost inaccessible, and the mine has been involved in two failures. Not a bright record, to say the least.

Cleverly enough, the advertising literature of the Idaho Copper Corporation has seemingly been centered in a sheet going under the name of the *Wall Street Iconoclast* and edited by none other than the notorious George Graham Rice, whose exploits are well known to our readers. A thin camouflage covers the fact that the *Iconoclast*, among other things, is designed to boost the stock of the Idaho Copper Corporation. Column after column extols the "virtues" of the Idaho Copper Corporation, and this hole in the ground is praised to the skies on the flimsiest sort of questionable data. It is not difficult to see the motive behind the effort to boost the Idaho Copper stock, for at the masthead of the *Iconoclast* one finds this illuminating statement: "The strength of the *Iconoclast's* opinion of any stock or stocks is . . . often based upon its financial interest in such stock or stocks."

Prior to the time that Stewart Campbell threw a monkey wrench in the machinery manipulating the Idaho Copper Corporation's shares, the boosters of the company had clear sailing. The stock was lifted well over 80c. per share, although it had been sold by the company for 10c. to a promoter before trading began. What a harvest the stock manipulator reaps! Then, on March 22, Stewart Campbell got busy. In a quick exchange of telegrams with officials of the Boston Curb he established the fact that the Idaho Copper Corporation had not fulfilled the corporation laws of the state and urged an investigation by the Boston Curb market. Mr. Campbell very wisely gave full and prompt publicity to his stand, furnishing the local and Boston press and this office with all details. This had at least one significant result. Three of the directors of the Idaho Copper Corporation resigned on April 20, branding it as a "stock-jobbing scheme rather than an honest attempt at the development of a mine." Furthermore, the Boston Curb on April 25 announced that trading in the stock of the Idaho Copper Corporation had been temporarily suspended. To date, however, the Boston Curb has not made public the result of its investigation of the Idaho Copper Corporation.

And now the Idaho Copper Corporation is threatening Mr. Campbell with a libel suit and also, we believe,

the directors of the corporation who resigned. Hence we are unable at the moment to record the concluding chapter in this extremely interesting story of stock manipulation.

Mr. Campbell's vigilance and courage in this affair are to be commended. He has rendered a real service to the state employing him. Not only that, he has aided the mining industries in general, for every shady mine promotion injures the orderly development of the legitimate mining venture by giving mining stocks a bad name and clogging the flow of capital to the worthwhile mining risk. Why cannot mine inspectors in other states take it upon themselves to watch the work of the fraudulent mine promoter, and, by turning the light of full publicity (the one thing that he cannot stand) upon his nefarious operations, mercilessly expose him?

Electric Heating and the Mining Industry

AS THE ELECTRICAL INDUSTRY has grown, the total motor horsepower in the United States has steadily increased, until today it almost equals the total primary horsepower in use. Comparatively a very small amount of electrical energy, however, is used for heating purposes—that is, for electric furnaces and ovens, for welding, for space heating, and for various accessories and devices in and about the plant. Looking ahead and knowing that the ideal way of heating is by electricity, one can readily believe that the future will see a great increase in the consumption of power to be converted into heat.

Except for aluminum, the electric furnace is scarcely used in the United States today for the production of the major metals. Nor does it seem likely that, for a good many years to come at least, it will be used for making any large tonnages of copper, lead, iron and steel, although in Norway, where hydro-electric power is cheap, a large quantity of steel is made by electric smelting. With zinc it may be different. Electrothermic smelting of zinc ores is said to offer many advantages. Progress in experimentation in this direction has been outlined by B. M. O'Harra, of the U. S. Bureau of Mines, in Bulletin 208, published in 1923. The electric furnace, in contrast to the Belgian furnace, permits the efficient utilization of energy, large units, easy attainment of high temperatures, and the possibility of treating complex ores.

A proposed plant for treating zinc ores by an electrothermic dry distillation process was described by Charles H. Fulton, of the Missouri School of Mines, in the *Engineering and Mining Journal* of July 1, 1922, on pages 8 to 14. In this article Professor Fulton assumed 1,400 kw.-hr. as the amount of energy necessary to treat one ton of 60 per cent zinc concentrates. Were the total tonnage of concentrates (about 62,500 tons per month) now smelted in the Belgian furnace reduced by this proposed method, the electrical energy required would approach the total motor horsepower load calculated by *Electrical World* for the country's metal-mining industries in 1920. We will not set the figure down, for the fear that some one might accuse us of writing a lurid prospectus for some of the public utilities interested.

With the modern trend toward doing things "the electrical way," we seem destined to become a nation of button pushers. The prospect is alluring. Already the furnace wrestling of a cold winter's morning is becoming more and more old-fashioned and giving way to thermostat control. Hasten the day when the stoking will also be conquered by the push button! The tasks that electrical energy can be made to do in the shop, the plant, the mine, and the home, and do them cleanly, quickly and efficiently, are many and of varied kinds. It will pay the superintendent and the foreman to hunt them out and study them. The cost of the electrical way will depend to some extent on power rates. The value of the time saved for the workman, however, is an important point to be considered. It will generally outweigh all others.

Isolation or Participation?

THE EDITOR of *The Forum* has written us, among others, for our opinion as to whether the United States should adopt a policy of isolation or of active participation in foreign affairs. In reply we have favored the middle course, believing that the United States cannot take either extreme—the wholehearted policy of co-operation, or that of complete isolation, with safety. The latter policy, indeed, is impossible. The United States should co-operate with intelligence and caution, making haste slowly, guarding its invaluable independence and autonomy and national individuality, and keeping clear of giving any nation or any international organization the right to say "You must" or "You must not." The American nation is possibly more generous, idealistic, and impulsive than the inhabitants of Europe or Asia; but the Happy Hooligan habit of rushing into help without counting the consequences would yield the customary Happy Hooligan finale.

We are citizens of a world that is growing closer knit every day, and we must recognize that more and more in our international relations. But in that complex task of organization which the world has before it, the United States can play a strong and helpful part only if it retain to the utmost possible its freedom of decision and hence its influence and power.

A World-wide Field

SCARCELY AN ISSUE of the *Mining Journal-Press* but contains some evidence of its world-wide field. Its international scope is natural, if for no other reason than the wanderings of the English-speaking mining engineer, who has his technical journal follow him wherever he may go. But the citizen of other countries, too, is a frequent reader, as our mailing list bears witness, and it is not unusual to find him a contributor. In the issue of May 2, a Japanese engineer, of Tokio, described at length a recent mineral reconnaissance in the Philippines, and an assistant professor of the Royal University of Stockholm, Sweden, discussed a method of substituting specific-gravity tests for chemical analysis. Australia, South America, Mexico and Canada were duly represented in numerous items of personal information. And, if further evidence of the international character of the mining industry were sought for in that issue, it could be found in the announcement of a conference to be held this summer in New England to discuss the topic of mineral resources as a new environmental factor in world affairs.

Australian Camps—Selwyn, Queensland

Town of Selwyn. Until 1920 this was the copper-smelting center of the northwestern part of Queensland

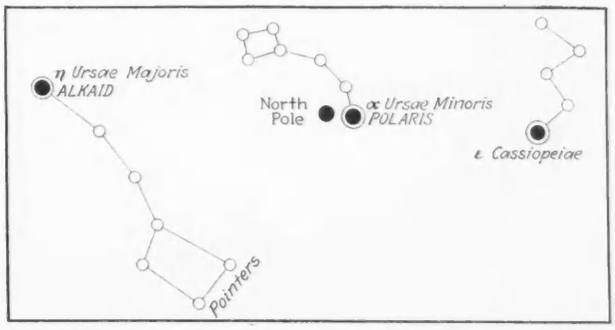
Mount Cobalt, 17 miles south of Selwyn. Here a 100-ton mill is treating 3-per cent cobalt ore. Power plant and tailings pond are seen

Mount Elliott smelter, which treated the copper ores of the Mount Elliott mine, at Selwyn; the Hampden mines, at Friezland; the Great Australia mine, at Cloncurry; and the Duchess, until economic conditions forced their shutdown in 1920

Photos by courtesy of A. W. Newberry.

Ward Method of Meridian and Latitude Determination

By Howard R. Ward
Wharton, N. J.



THIS NEW METHOD of meridian and latitude determination is simple, rapid, and accurate; computations are reduced to a minimum; accurate time is not needed; and the tables can be conveniently carried in a standard field book. The method is available whenever the stars are visible except as explained in "Note 3."

Method of Operation for Meridian Determination

Set transit plates at zero. Point the telescope at POLARIS. Note the time. Unclamp upper plate and point telescope at ε CASSIOPEIAE or ALKAID, at moment when TIME INTERVAL (see table) has elapsed. Read horizontal angle, and multiply it by FACTOR (see table). Keeping lower plate clamped, lay off resulting angle towards ALKAID. Telescope now points to POLE.

NOTE 1. Repeat with telescope reversed and use mean result. Accuracy is within ten seconds if nearest degree of latitude has been used in FACTOR TABLE. For greater accuracy interpolate factor for intermediate latitude.

Latitude Determination

Level instrument carefully. Sight on POLARIS. Note vertical angle, calling it A. Note time. Sight at ALKAID or ε CASSIOPEIAE, preferably using whichever is highest if not over 90 deg. altitude, at moment when TIME INTERVAL (see table) has elapsed. Note vertical angle, calling it B. Subtract refraction correction (see table) from each angle, calling results A′ and B′. Subtract lesser angle from greater angle, calling result C′. Multiply C′ by FACTOR (see table), calling result D′. If sighting on ε CASSIOPEIAE above POLARIS, or on ALKAID below POLARIS, subtract D′ from A′; if sighting on ε CASSIOPEIAE below POLARIS, or on ALKAID above POLARIS, add D′ to A′. The result is LATITUDE.

NOTE 2. Repeat with telescope reversed and use mean result. Accuracy is within fifteen seconds if nearest degree of latitude has been used in FACTOR TABLE, and if REFRACTION CORRECTION is closely interpolated. If latitude is not known to nearest degree, estimate latitude and use first determination in refiguring for a final determination.

NOTE 3. In certain latitudes, at certain seasons, near culmination of the stars used, there may be a short period when one is too high and the other too low for observation. This is the only period to be avoided.

NOTE 4. Use of prismatic eye piece will facilitate observations when stars are at high altitudes.

REFRACTION

Altitude	Correction
10°	5′19″
10½°	5′04″
11°	4′51″
11½°	4′39″
12°	4′28″
12½°	4′17″
13°	4′07″
13½°	3′58″
14°	3′50″
14½°	3′41″
15°	3′34″
15½°	3′27″
16°	3′21″
16½°	3′14″
17°	3′08″
17½°	3′03″
18°	2′58″
18½°	2′52″
19°	2′48″
19½°	2′43″
20°	2′39″
20½°	2′35″
21°	2′31″
21½°	2′27″
22°	2′23″
22½°	2′20″
23°	2′16″
23½°	2′13″
24°	2′10″
25°	2′04″
26°	1′59″
27°	1′54″
28°	1′49″
29°	1′45″
30°	1′41″
31°	1′37″
32°	1′33″
34°	1′26″
36°	1′20″
38°	1′15″
40°	1′09″
42°	1′05″
45°	0′58″
48°	0′53″
52°	0′46″
56°	0′39″
60°	0′34″
64°	0′28″
70°	0′21″
80°	0′10″

1925 TIME INTERVALS

Date	ε Cassiopeiae Min.	Sec.	Alkaid Min.	Sec.
Jan. 1	14	13	9	47
Jan. 15	14	28	10	03
Feb. 1	14	46	10	22
Feb. 15	15	01	10	39
March 1	15	14	10	53
March 15	15	24	11	04
April 1	15	30	11	10
April 15	15	32	11	12
May 1	15	28	11	08
May 15	15	21	11	00
June 1	15	10	10	49
June 15	14	56	10	34
July 1	14	40	10	17
July 15	14	24	10	00
Aug. 1	14	07	9	41
Aug. 15	13	52	9	25
Sept. 1	13	39	9	11
Sept. 15	13	28	8	58
Oct. 1	13	20	8	50
Oct. 15	13	16	8	46
Nov. 1	13	15	8	45
Nov. 15	13	20	8	50
Dec. 1	13	27	8	58
Dec. 15	13	38	9	10
Dec. 31	13	54	9	27

1926 TIME INTERVALS

Date	ε Cassiopeiae Min.	Sec.	Alkaid Min.	Sec.
Jan. 1	13	54	9	27
Jan. 15	14	10	9	44
Feb. 1	14	27	10	02
Feb. 15	14	44	10	21
March 1	14	56	10	33
March 15	15	06	10	45
April 1	15	13	10	52
April 15	15	14	10	53
May 1	15	12	10	50
May 15	15	04	10	42
June 1	14	53	10	30
June 15	14	38	10	15
July 1	14	23	9	58
July 15	14	07	9	41
Aug. 1	13	51	9	24
Aug. 15	13	36	9	07
Sept. 1	13	21	8	52
Sept. 15	13	10	8	40
Oct. 1	13	03	8	32
Oct. 15	12	59	8	28
Nov. 1	12	58	8	27
Nov. 15	13	02	8	31
Dec. 1	13	10	8	39
Dec. 15	13	22	8	52
Dec. 31	13	37	9	08

FACTORS 1925

Latitude	ε Cassiopeiae	Alkaid	Latitude	ε Cassiopeiae	Alkaid
20°	.04264	.02614	42°	.04134	.02382
21°	.04260	.02610	43°	.04123	.02356
22°	.04258	.02606	44°	.04110	.02326
23°	.04255	.02601	45°	.04096	.02291
24°	.04251	.02595	46°	.04080	.02250
25°	.04248	.02590	47°	.04064	.02200
26°	.04244	.02584	48°	.04046	.02134
27°	.04240	.02577	49°	.04027	.02037
28°	.04236	.02570	50°	.04005	.....
29°	.04231	.02563	51°	.03981	.....
30°	.04225	.02555	52°	.03954	.....
31°	.04221	.02546	53°	.03925	.....
32°	.04216	.02537	54°	.03892	.....
33°	.04210	.02527	55°	.03854	.....
34°	.04204	.02516	56°	.03811	.....
35°	.04197	.02504	57°	.03762	.....
36°	.04190	.02491	58°	.03705	.....
37°	.04182	.02477	59°	.03640	.....
38°	.04174	.02462	60°	.03553	.....
39°	.04165	.02445	61°	.03448	.....
40°	.04156	.02426	62°	.03302	.....
41°	.04145	.02405	63°	.03048	.....

FACTORS 1926

Latitude	ε Cassiopeiae	Alkaid	Latitude	ε Cassiopeiae	Alkaid
20°	.04243	.02602	42°	.04114	.02370
21°	.04240	.02598	43°	.04102	.02344
22°	.04238	.02593	44°	.04090	.02315
23°	.04235	.02588	45°	.04077	.02280
24°	.04232	.02583	46°	.04062	.02239
25°	.04228	.02578	47°	.04046	.02189
26°	.04225	.02572	48°	.04028	.02124
27°	.04221	.02565	49°	.04008	.02032
28°	.04216	.02558	50°	.03986	.....
29°	.04212	.02551	51°	.03962	.....
30°	.04207	.02543	52°	.03936	.....
31°	.04202	.02534	53°	.03906	.....
32°	.04196	.02525	54°	.03873	.....
33°	.04190	.02515	55°	.03836	.....
34°	.04184	.02504	56°	.03794	.....
35°	.04177	.02492	57°	.03745	.....
36°	.04170	.02479	58°	.03688	.....
37°	.04163	.02465	59°	.03620	.....
38°	.04155	.02450	60°	.03538	.....
39°	.04146	.02434	61°	.03432	.....
40°	.04136	.02415	62°	.03288	.....
41°	.04126	.02394	63°	.03036	.....

Practical examples are presented on the following page (798).

Examples of the Ward Method of Meridian and Latitude Determination

(Article on page 797)

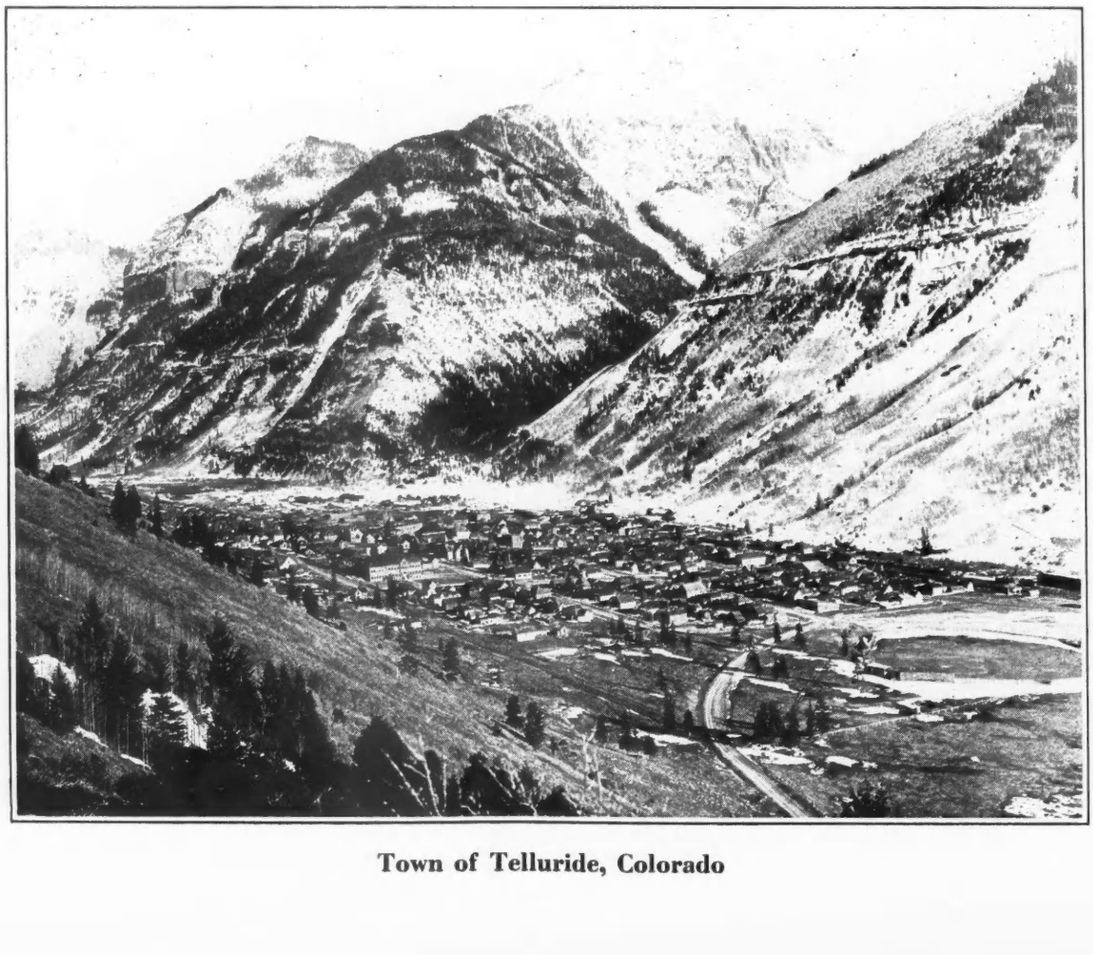
The following examples will clearly show the method of use:
Latitude about 42° N. Date April 15, 1926.
Alkaid observed, above and to right of Polaris.

Meridian

Transit set at 0°. Sighted at Polaris.
10 minutes 53 seconds later (see time-interval table) sighted on Alkaid.
Horizontal angle 10° 02′ 30″ to right.
10° 02′ 30″ reduced = 36,150″.
36,150 × 0.02370 (see factor table) = 857″.
857″ expanded = 0° 14′ 17″.
Without moving lower plate, set off 0° 14′ 17″ to right (toward Alkaid).
Telescope now pointed to true North.
Set a point on Meridian.

Latitude

Transit leveled carefully. Sighted at Polaris.
Vertical angle A = 41° 15′ 30″ (Altitude Polaris).
10 minutes 53 seconds later (see time-interval table) sighted on Alkaid.
Vertical angle B = 72° 16′ 00″ (Altitude Alkaid).
41° 15′ 30″ — 0° 01′ 05″ (see refraction table) = A′ = 41° 14′ 25″.
72° 16′ 00″ — 0° 00′ 21″ (see refraction table) = B′ = 72° 15′ 39″.
72° 15′ 39″ — 41° 14′ 25″ = C′ = 31° 01′ 14″.
31° 01′ 14″ reduced = 111,674″.
111,674 × 0.02370 (see factor table) = 2,647″.
2,647″ expanded = D′ = 0° 44′ 07″.
A′ + D′ = 41° 14′ 25″ + 0° 44′ 07″ =
41° 58′ 32″ = Latitude.



Town of Telluride, Colorado

Price and Value of Copper

Compared with Other Commodities, the Metal Is Constantly Getting Cheaper, Thanks to Triumphs of Mining Engineers and Metallurgists—Ten-cent Copper to Come?

By William Spence Black
Mining Engineer, Boston, Mass.

THIS ARTICLE will be confined to a study of copper prices and their corresponding *values;* no attempt will be made to analyze the supply and demand of the past or of the future, except as they are expressed or indicated by their function—price.

The price of copper varies between wide limits, and even average prices depend largely on the period covered. For instance, the "pre-war price" is 13.92c. if a thirty-year period be considered; 14.56c. for a twenty-year period; and 15.59c. for the years 1905 to 1914 inclusive. In Fig. 1 are plotted the average annual copper prices for the last forty years, and the horizontal shaded band across the face of the graph outlines the zone of average prices. The width of this band indicates the wide variation in the averages, according to the period considered. The violent fluctuations in yearly prices make evident the futility of predicting what the price will be one, two, or ten years from now, based merely on what the prices have been in the past.

Economic conditions should be carefully studied in any consideration of copper prices. In the early 1900's the automobile was the horseless carriage; the telephone was not common, electric light was absent even in many of the better homes, and electrical power and apparatus were used on a comparatively small scale. But today the demand for copper is dominated by the industries that furnish these products and services, and they consume nearly 60 per cent of the copper used in the United States. In the matter of supply a comparable change has taken place. Cheap steam-shovel mining has been introduced; flotation has greatly improved recoveries; leaching and electrolytic precipitation have made the treatment of low-grade deposits possible at a good profit; reverberatory smelting with oil and powdered coal has largely displaced the more expensive coke-fired blast furnaces; and electrolytic refining has improved the quality of copper and made possible the recovery of valuable byproducts. The coincidence of a greatly broadened demand in new industries, a greatly improved technique in production, and an upset condition during the last ten years due to the World War, makes the past price record of copper a poor criterion of the future. It might be inferred from a study of Fig. 1 that the price trend of copper is downward over a sixty-year period. On the other hand, in the period from 1894 to 1914 there was a definite upward trend.

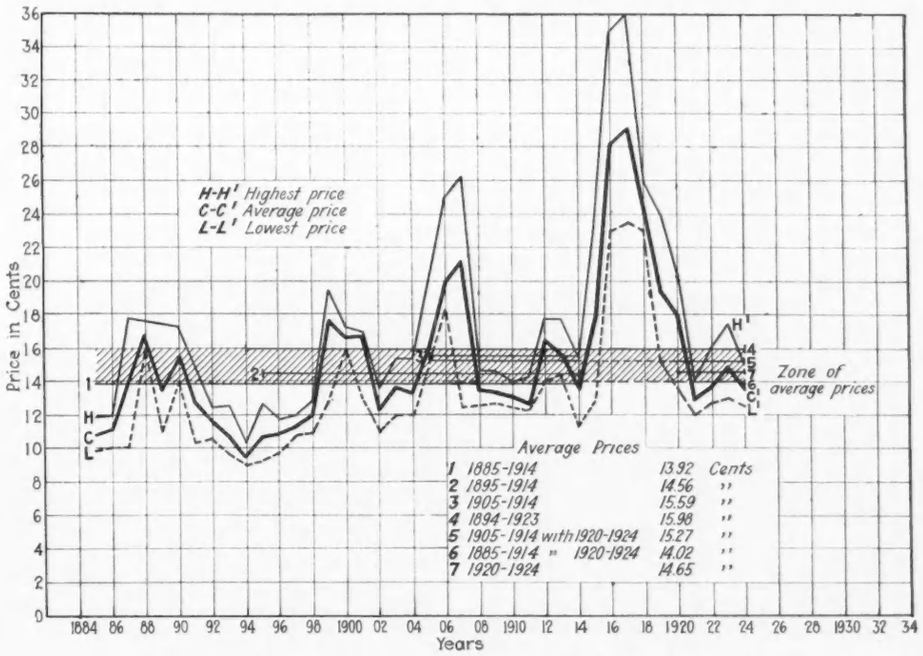


Fig. 1—Average annual copper prices, showing price range in each year and zone of average prices

In Fig. 1 are also given the high and low prices for the individual years. The average annual variation in price is 3.57c. and it would seem that this fluctuation between the high and low prices may, in general, be anticipated in future years.

The prices of copper in the past have, of course, varied with supply and demand. A direct study of prices *per se*, fails to reveal any significant factors applicable to the future. One probable reason for this is that the price of copper in cents is the *value* of copper in hundredth parts of the gold dollar. The *value* of the gold dollar fluctuates, so the price of copper fluctuates even though other conditions remain the same. Consequently, the price of copper varies not only in response to supply and demand, but also in response to the changing value of the dollar. Prices resulting from these combined influences may therefore exhibit an erratic and apparently unintelligible behavior when, as a matter of fact, they may be actually recording a regular and persistent change in the relationship between supply and demand. To investigate this possibility one must study the past *value* of copper in terms of some other commodity than gold. Such values are, of course, exchange values, and are expressed by the quantity of a selected commodity or group of commodities that may be secured by barter or purchase for a given quantity of copper. The quantities may be pounds of lead, ounces of silver, bushels of corn or wheat, tons of steel, or even quarts of milk—in fact any commodity and its common unit of measure may be utilized.

Following out this idea, one may determine the average value of copper by years in terms of commodities or groups of commodities, and develop the fact that the value of copper has not increased in proportion to the increase in value in many other commodities. There is nothing new in this idea, but a blunt statement that the value of copper has *decreased* makes possible a real appreciation of the situation and reveals the true predicament of copper.

The extent of this decrease in the value of copper may be determined by a study of past average copper values. The past values may be determined by a study of exchange value in terms of commodities, or one may resort to index numbers such as are prepared by the U. S. Bureau of Labor and statistical organizations. These index numbers or indices express the relative purchasing power of the dollar for the commodities used and serve as a ready means of converting prices to values. For the purpose of this article I will use Dun's index numbers, which are defined "as a measure of the cost of living in the United States." A scale that measures the cost of existence for an individual member of society cannot be bettered for measuring the value of a commodity to the world at large.

Dun's indices for the years 1885 to 1924 are plotted in graphical form in Fig. 3. The index for 1903 is 99.46, very nearly 100, so we may consider that these indices will yield values in terms of the 1903 dollar.

Copper sales are usually for future delivery, and appreciable quantities of copper are disposed of under long-term contracts; furthermore, copper that is purchased in the form of wire bars or ingots is not fabricated and again in the market for months. Purchasing agents and the sellers discount future conditions for several months ahead, and the net result is that copper sold in one year is in reality marketed with anticipation of conditions six months or even a year ahead. The *value* of copper for a given year is, therefore, not necessarily determined by applying the index for that year to the price for that year, and in some years, and particularly the war years where the annual variation in the size of the index numbers was abrupt, the value is more properly secured by applying the index for the following year to the price of a particular given year.

If the average annual price of copper in each year be divided by the index numbers for the year following, the result will express in cents the average value of copper; that is, the value of copper in cents based on the 1903 dollar.

The results by years are plotted in graphical form in Fig. 2 and reveal the startling discrepancy and widening rift between price and value. A study of the chart shows that in 1903 the value of copper was 14.12c., and that in 1923 the value was only 8.06c. What does this mean? Just this—that whereas in 1903 one pound of copper would yield by barter or purchase 14.12 units of certain essential commodities, in 1924 an identical pound of copper would purchase only 8.06 units of the same commodities. Or, to express the situation in another light, 8.06 lb. of copper would buy a certain quantity of goods in 1903, but to secure these same goods in 1923 one had to exchange 14.12 lb. of copper. Obviously, the *value* of copper has decreased materially, and yet if the comparison had been confined to prices, no great distinction would be noted, for the price of copper in 1903 was 13.72c., and in 1923 it was 14.96c.

A steady and generally consistent depreciation in the value of copper has occurred since 1907. Even the war-time prices yield values that are less than those of twenty-five years ago, though the governmental price-fixing that existed in 1917 and 1918 may have accounted for this.

From the plotted graph of values may be derived a curve that approximates the trend of values for the last twenty-five years, and this curve is shown on the plot. The trend of this curve is unquestionably downward, and although personal inclination may vary the exact position of the upper limit by selecting a different year as the start, and thereby vary the trend and the average value for the present and immediate future, I feel that the curve shown is representative of past value and indicative of future values. A flattening of the curve as it approaches a basic value seems proper, and the curve is projected into future years with a flattening approach to a copper *value* of 6c.

If the fact of decreasing copper values is accepted and the assumption made that this past trend is to continue for the next five or ten years in general accord with the average curve shown, one is confronted with the possibility of even lower copper values, tending to approach a minimum value of 6c. I am speaking of course of *values*, not prices, and the general trend of values seems substantiated not only by the graphical plot of the statistical data but also by actual conditions of supply and demand within the copper industry. Copper producers in 1900 received a value of 18.25c. for each pound of copper. In 1935 the producers of copper may receive a value of 6c. for every pound of copper. Three pounds of copper may purchase only as much other commodities in 1935 as one pound of copper purchased in 1900! Offhand, this appears to be a

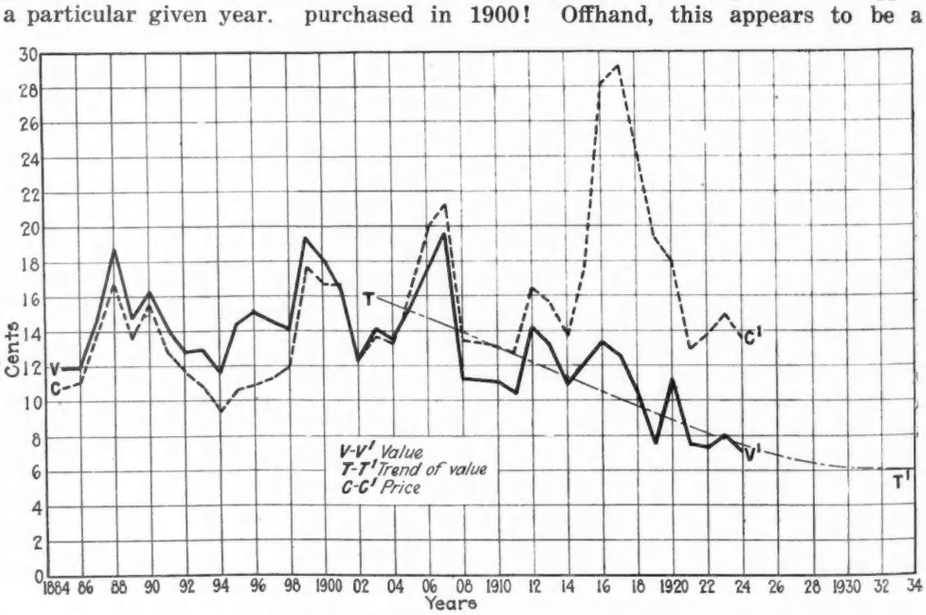


Fig. 2—Average annual copper values, showing the trend

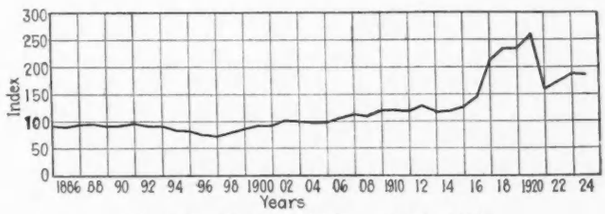


Fig. 3—Dunn's Index, 1884-1924

rather depressing contemplation, and yet under more careful analysis it will be recognized as an achievement of the first magnitude and will constitute a service of inestimable value to society.

Triumphs of Engineers Unheralded

The present generation can produce two pounds of copper where only one pound was produced before. This in itself is an achievement, and, if a digression may be pardoned, a tribute is in order to the mining engineers who have made possible the development and exploitation of our sources of copper, and the metallurgists who have developed the methods of treatment that make possible its successful extraction. Let the farmer improve his yield, so that two blades of grass grow for the single blade of the past, or the factory produce comparable values in shoes or automobiles, and the fact is heralded to the four corners of the earth, and great is their reward in material things and in public esteem. Yet the copper producers through their technical staffs have accomplished this very thing, and far from being recognized as an achievement worthy of reward and public esteem, are subject to querulous inquiries of an undiscerning public as to what is the matter with the copper industry. Nothing is the matter with the copper industry. Let the technicians of the copper industry take proper pride in their achievement. Let them educate the world at large to an appreciation of the accomplishment, and at the least they will derive some measure of public confidence and a greater measure of public esteem.

How Will Prices Be Affected?

I have been discussing values and their probable future as shown by the past and present trend: now consider the effect of these probable future values on future prices. Price is the product of the index number and value. We have determined probable future value and are now confronted with a choice of index numbers for these values. The index numbers for the past forty years are plotted in graphical form in Fig. 3. On the whole, their behavior is more stable and consistent than prices. They show a slight but remarkably uniform rise in the years prior to the war; they show an abrupt but consistent rise throughout the war period; and a deliberate drop in the 1921 deflation, which was followed by another increase. On the whole, the variations in the index numbers have been consistent and, excepting war years, the annual fluctuations are small. A similar behavior may reasonably be expected for the future, barring the possibility of acute political or economic crises, and the range in index numbers for the next five or ten years may not be great. Whether the general trend will again be upward, as before the war, or downward, in response to the pressure of the long-swing cycle, is a matter of personal choice. Certainly it is hard to believe that indices equal to those in the later-war and post-war years will return, and there seem some grounds for expecting lower, rather than higher, indices.

The present cost of living is tremendously higher than that immediately before the war, and though our living may be on a higher plane, it is possible that it may be lowered. The pound sterling is back to gold parity, European countries practice rather terrifying economies, we have heard a cry of distress among the copper producers and a plea for a protective tariff; recently the *Iron Trade Review* has commented on the fact that steel products of foreign origin are invading even the Middle West, and again the tariff wall is mentioned. Our tin smelters have departed to more profitable shores, and now the largest consumer of pig lead contemplates a similar move because, "wages, administration and sales expense are twice as large as in the companies in which we are interested in Europe." (See leading editoral in the *Mining Journal-Press* of March 21, 1925.) If such conditions confront us there must be inflation somewhere, and, tariff or no tariff, deflation must eventually occur, and the cost of living will decline, and lower indices will result.

If the prognosticated values for copper be accepted, the probable future prices for copper may be derived by choosing an index that agrees with one's own convictions regarding future economic conditions and their effect on the cost of living. The present value of copper is about 7½c.; the future indicates values of 7c. and even 6c. The expected prices for each of these values, with varying indexes, are shown in the following tabulation:

Index	Value, Cents	Price, Cents	Index	Value, Cents	Price Cents
260	8	20.8		6	10.8
	7	18.2	140	8	11.2
	6	15.6		7	9.80
220	8	17.6		6	8.40
	7	15.4	100	8	8.00
	6	13.2		7	7.00
180	8	14.4		6	6.00
	7	12.6			

These results are shown in graphical form in Fig. 4, and from this chart the price for any of these three values and any selected index may be derived.

A study of the results indicates low copper prices. Few would select an index of 260 for the coming years, for this was the maximum index of our record and even exceeds that of the war years. Neither may we select the index of 220, which closely corresponds to the war-time average. If the 1924 index be accepted, which is about 180, a range in price from 14.4 to 10.8c. is possible. The contemplation of an average selling price of 11c. is rather startling, but if it be considered that lower indices are possible, one may be dismayed to observe that even lower prices are possible, and 10c. or

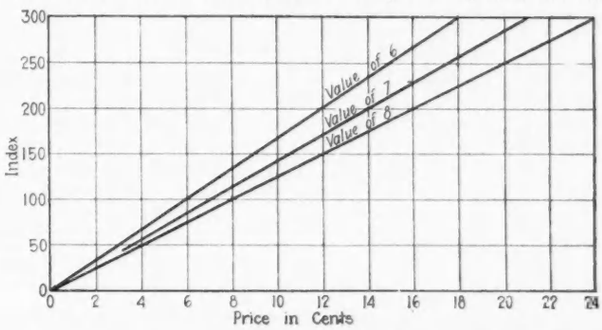


Fig. 4—Copper prices and values, with varying index figures

even 9c. may be the average selling price in years to come. Impossible? I think not. The cost of production? That too will change. A 10c. expense with an index of 180 shrinks to only 7.78c. with an index of 140. A 10c. cost is too low? No, not for the fittest.

The Federal Trade Commission reported the average cost of producing copper in 1918 as 16.167c. per pound. This average was compiled from the costs of eighty-five of the largest producers, and the individual costs varied from below 12c. to as much as 34.614c. per pound. This average is high without question. It includes forty-four companies whose costs exceeded 20c., but, disregarding this for now, let me reduce this 1918 cost to terms of the 1924 dollar. The index for 1918 was 232.58; the index for 1924 was 185.49. In cents of the 1924 dollar, the 16.167c. cost of 1918 is only 12.893c., which, if allowance is made for the high-cost producers, many of whom were only producing because of the war-time scarcity, will not be far from 10c. Still lower are the costs of the porphyry group. The Trade Commission gave their costs as 14.886c. In cents of the 1924 dollar, this cost is only 11.871c. Furthermore, it included 1.66c. for depletion and depreciation. Neither of these items is operating cost; they are practically speaking part of profit, and the funds set aside for these charges are available for dividends and are generally distributed as such. Deducting a proportional part of this amount gives an average cost very close to 10c. per pound for present production among the large, low-grade producers in the United States, and he who would argue that the present average cost of producing copper is now well above 10c. may derive some profit from reflection on these figures, which are well substantiated.

Even lower costs are possible, and although a thorough analysis of costs and profits is not within the scope of this article, it is of interest to consider some production costs that are on record in years with lower indices. The U. S. Geological Survey reported the average costs of producing electrolytic and casting copper in the pre-war years as follows:

Year	Cost, Cents	Index
1912	8.74	122.28
1913	9.49	116.32
1914	8.62	119.71
1915	7.86	124.96

The costs of some producers undoubtedly approach, and even exceed, present selling prices; such marginal producers are always with us. There are likewise producers with costs below 10c.—all large producers—and the tendency is for their number to increase and their costs to decrease.

The present is the child of the past and the parent of the future, and though the grandparent of the coming generation of copper producers may tremble with other grandparents to think what has come over his line, he cannot but express amazement and pride in the strength, virility, and magnitude of this new issue.

Width of Vein in Verde Mine

In the article on "Geology of the Verde Central Mine" in the *Mining Journal-Press* of April 11, there appeared one typographical error which, in justice to the men who have been backing operations, should be brought to the attention of your readers. The last sentence in the third paragraph on page 611 reads: "More important than the fact that the vein was 1 ft. wide here and ran 3 per cent is the proof that it persists with depth." The vein was 11 ft. wide where cut, rather than 1 ft.

Russian Iron and Manganese Industry Improving

Ores mined in Russia during the fiscal year ended Oct. 1, 1924, included iron, manganese, copper, asbestos, magnesite, chrome, and lead-zinc, according to the *Russian Review* of April 1, 1925. Iron ores were the most important, though the total quantity (excluding those produced in Poland and Finland) was only about 10 per cent of that produced in 1913. Still, this was more than twice as great as the tonnage produced in the preceding fiscal year, so progress was made. Of the forty-nine mines in the Krivoy Rog region, only four of the largest mines were working during the last year; in the Urals, only the largest and most favorably situated were operated; and in the Kerchensky region there was no activity at all. The total tonnage produced in the entire country for the year was 990,000 tons. The ore from the Urals was smelted in the furnaces owned by the mining companies, but that from the Southern Ore Trust was shipped to the works of the Southern Steel Trust and the Kramatorsky works. Production for the current year is expected to be doubled over that for 1923-24.

The sources and amounts of manganese ore were as follows:

	1923–24 Tons	1922–23 Tons	1913 Tons
Chiaturi	305,000	165,000	1,070,000
Nikopol	108,000	72,000	280,000
Totals	413,000	237,000	1,350,000

At Nikopol, according to Russian authorities, the work of extracting manganese ore is being conducted by the Southern Ore Trust, and at Chiaturi by numerous lessees from among those who formerly operated manganese industries on a small scale, who were granted the right, by a special decree of the Council of People's Commissars of Georgia (July 20, 1922), to operate their former mines under leases and on conditions fixed by the decree. But at the same time the Government of Georgia has undertaken steps to organize the manganese industry with government funds; thus beginning with August, 1923, government ore operations began in the mines of the former "Caucasian Manganese Co.," and it was proposed in the near future to begin such operation in other units also.

The manganese ore mined in 1923-24 was all for export. The domestic market demanded little of it, because the southern plants had sufficient supplies of ore for their own requirements.

In the Nikopol region the average number of workers employed for the year was 1,630; the annual productivity was 67 tons of ore per man, compared with 180 tons before the war; in other words, 37.5 per cent. At Chiaturi the average number of workers was 1,300, and the productivity for the year was about 234 tons per man. This striking difference is explained by the fact that the deposits of the Chiaturi region are presenting many advantages for extraction as compared with those at Nikopol.

The production cost, f.o.b. mine, of manganese ore, based on data for half a year for Nikopol and for the entire calendar year 1923 for Chiaturi, amounted to the following (in kopeks per pood):

	Wages	Materials	Fuel	Other Expenses	Concentrating	Total
Nikopol	5.20	2.96	0.44	3.16	6.27	18.03
Chiaturi	3.98	2.79	....	5.35	10.17	22.29

Further information is also given in the periodical mentioned.

Gunite Construction in Honduras

How the Work of Building a Million-gallon Power Reservoir Was Done With Native Labor

By Samuel G. Lasky

Formerly Construction Engineer with New York & Honduras Rosario Mining Co.

WHAT IS BELIEVED to have been the first use of gunite in Central America was on the construction of the million-gallon power reservoir of the New York & Honduras Rosario Mining Co. at San Juancito, Honduras, which has recently been completed. This work was done with the ordinary native labor and with a speed that compares favorably with similar work in the United States. The reservoir was built to take the place of a small wooden penstock used to unite the flow from two convergent flumes bringing water from opposite sides of the mountain. From the penstock the water drops 1,350 ft. to the power plant.

Excavation was begun as soon as construction was decided upon. The ridge on which the site was chosen is composed of hard, slaty folded and fractured shale which has been considerably weathered, and it was necessary, before final plans for lining could be drawn up, to determine to what depth weathering had extended and how much it had changed the character of the rock. Three possible methods of lining could be used: (1) Poured concrete with waterproofing either incorporated in the concrete or painted on the surface; (2) masonry with a troweled cement facing; and (3) gunite. Work on the excavation brought out that practically the whole point of the ridge had undergone considerable weathering and that most of the wall area of the reservoir would be in a soft, clayey rock which was somewhat impermeable of itself. After determining the character of the rock, other specifications were drawn up to be followed in the design.

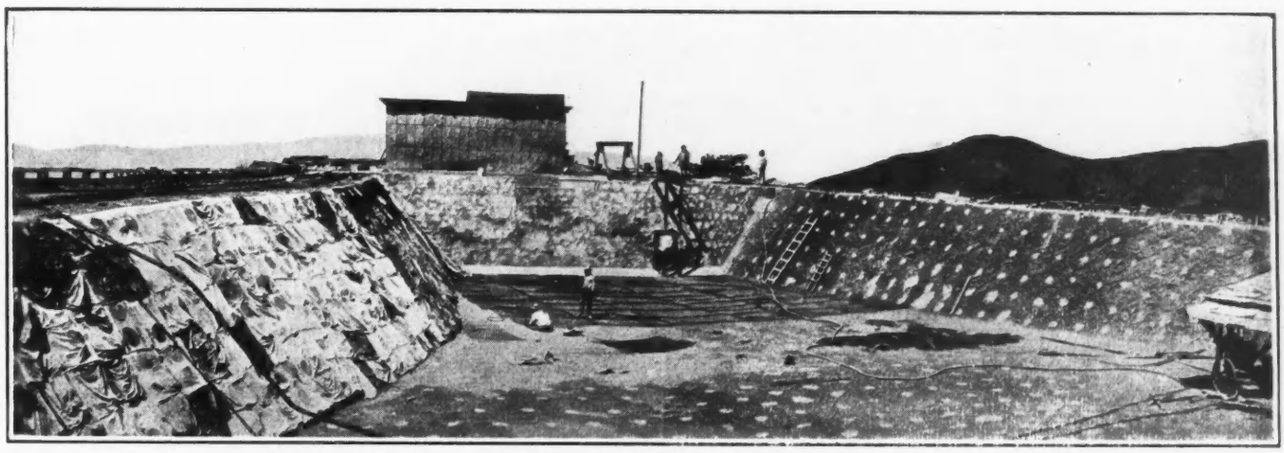
The reservoir was to be somewhat trapezoidal in shape to conform to the contour of the site. It was to be divided into two parts, a forebay having a capacity of about 7,000 cu.ft. and a main reservoir with a capacity of about 120,000 cu.ft.

Under ordinary conditions water should enter the forebay. Excess water over that needed to run the plant would overflow through a weir in the dividing wall into the main reservoir, to be drawn out when needed. Inlets were to be so arranged that the water could be turned into either the forebay or the reservoir. Outlet valves were to be so arranged that water could be drawn from either compartment individually or together. A sand trap was to be placed on each canal to catch all sand and dead leaves before the water entered the reservoir.

Specifications as they appeared on the final blueprints and as carried out were as follows:

The dividing wall forming the forebay to be constructed of rubble masonry with a ¾-in. coating of gunite on each side and to be built across the narrow end of the reservoir.

The reservoir to be given a monolithic lining of a minimum of 2 in. of gunite applied directly to the dirt surface and reinforced with 12-gage Steelcrete expanded metal placed exactly in the center of the gunite, the reinforcing to be held in the proper position by wiring it to lagscrews grouted into the surface on 30-in. centers.



The main reservoir. The gun can be seen in the lower right-hand corner. Notice the men laying the reinforcing. The white spots are the grouting holding the lagscrews. The men are placing the mats of expanded metal in position

The gunite, it was specified, was to be of a 3 to 1 mix.

Excavation was begun in the midst of the rainy season, and it was planned to complete it by the beginning of the dry season, so that the guniting could be done during the summer. The excavating was completed in scheduled time, the walls were trimmed down, and everything was in readiness for guniting, which only awaited the arrival of supplies which had already entered the country. However, just at this time a revolution broke out, and all transportation was stopped. It was almost four months later, after the dry season had passed, before the materials could finally be delivered. Construction, therefore, had to be carried over into the rainy season, as it was impossible to delay the work for another year. So that the work would go on as expeditiously as possible, even while it was raining, light canvas-covered shelters were built, under which the nozzleman could stand and which would protect the fresh gunite from the rain. These shelters could easily be moved from place to place as required. The workmen were provided with "capotes," or raincoats, improvised from the waterproof sacks in which the cement arrived. Often after a heavy rain there would be 6 in. or more of water in the bottom of

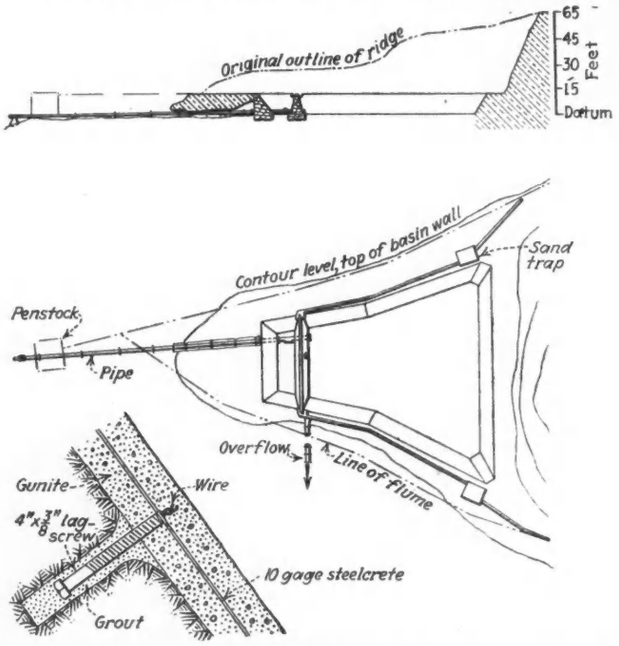
the reservoir. These heavy rains usually came late in the afternoon, making it possible to remove the water overnight, which was done with a number of siphons built of 1-in. pipe.

Inasmuch as it had been planned to do the guniting in the dry season, an air drier had not been ordered with the gun, and considerable trouble developed through the wet sand setting the cement in the gun. The stirring arm and feed wheel would cut out a path for themselves, while the remaining material would set into a solid piece. This trouble was finally remedied by changing the shape of the stirring arm to bend further down and then welding on another piece at right angles to it to extend up into the material above the wheel, keeping it constantly stirred up.

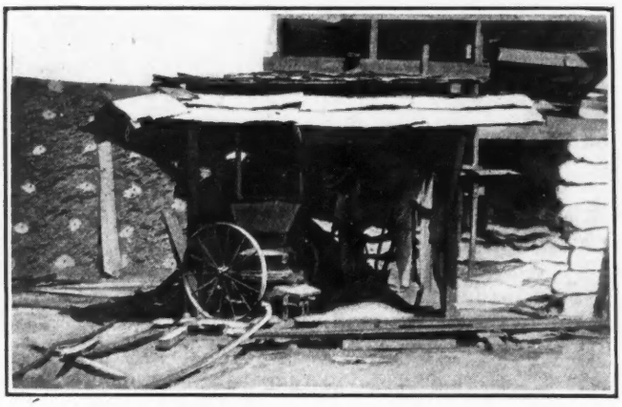
The sand used for the mix was obtained by stamp-milling quartz brought from barren veins in the mine. The stamps were equipped with 4-mesh screen and the discharge was washed in a 40-mesh trommel. A sizing test showed 64 per cent plus 30 mesh with 0.4 per cent minus 100 mesh—that is, a proper ratio between the coarse and fine, with almost no powder. There was, of course, no organic material in the sand. The rebound on the work, which averaged about 12 per cent, was collected and thrown into the sand bin to be used over again, properly proportioned with fine, clean sand.

Under average conditions, from 95 to 100 sq.ft. of gunite 2 in. thick could be shot an hour. This average was lowered considerably for the whole job by days of heavy rains, when little work could be done, and by fog, producing wet air which caused the cement to set in the gun and in the hose. However, after the stirring arm in the gun had been changed, most of the trouble due to wet air was eliminated. One sack of cement, 125 lb. net, would cover about 15 sq.ft. of surface.

The cost of the work was approximately $53 per 100 sq.ft. of surface, divided as follows; Labor, including setting of reinforcing, $2.50; and material, $51.50.



Plan and section of New York & Honduras Rosario Mining Co.'s million-gallon power reservoir. The detail shows method of arranging lagscrews and expanded metal



A close-up view of the cement gun

The labor cost of $2.50 includes part of the salary of the engineer in charge. The actual labor cost was about $1.50 per 100 sq.ft. of surface. Considering the extremely low wage scale for the native labor, it will be readily admitted that the cost of superintendence should not be included in making a comparison with American costs.

Air pressure on the gun was carried at about 32 lb. The pressure on the water was carried as high above this as the compressor would permit, averaging about 50 lb. The gun was a No. N-1 with a maximum length of hose of 150 ft.

The reservoir, as completed, has an available capacity of approximately 120,000 cu.ft. of water. The power plant, when every department of the property is running at full capacity, requires 600 cu.ft. a minute. Therefore, if both canals should break down at once and no water were to enter the reservoir, it would contain enough water to keep the plant operating the full capacity for over three and a quarter hours, a sufficient length of time to permit temporary repairs to be made. This advantage exists only in the wet season, when, with both canals in condition, there is plenty of water and the reservoir will always be full.

It is in the dry season that the main benefits are derived. There are occasionally heavy showers at the beginning and end of the season, which for a short while furnish more water to the canals than the power plant requires. This excess water, which previously was allowed to escape, is now caught in the reservoir and can be used when needed. At this time of the year not enough water is furnished by the canals to allow all the works to run at full capacity. During the night, however, when only the mill is in operation, there may be more water than is required, which can now be saved and drawn out during the next day to permit the mine to run at fuller capacity. The reservoir should pay for itself in increased production in a short time.

Potash in 1924

Returns received by the U. S. Geological Survey from the producers of potash in the United States indicate that the output in 1924 amounted to 43,719 short tons of crude potash salts containing 22,896 short tons of potash (K_2O). The sales amounted to 37,492 short tons of crude potash containing 21,880 short tons of K_2O, valued at $842,618. Over 30,000 short tons of crude potash were held by the producers Dec. 31, 1924.

Shall the Federal Government Finance Construction of Debris Dams?

A Suggestion for the Solution of the Hydraulic Gold Mining Problem in California

By Major H. A. Finch
Corps of Engineers, U. S. Army

THERE IS SOMETHING FASCINATING about digging your own gold out of the ground: something so much more stimulating in this short-cut to wealth than in such roundabout methods as raising hogs or cantaloups and converting them into money. From time immemorial men have responded to this lure and have been willing to sacrifice the comforts of home and the security of civilized jobs in their search for the precious metal.

There have been many gold "rushes," but it is doubtful if there ever was one to equal the stampede to California after 1848. The history of that period has yet to be written, but when it is the production figures used will have to be large. It has been said that within a year after discovery of gold 100,000 men had flocked into the bonanza region and that during the following three years shipments of gold averaged $50,000,000 annually.

Early in the "game" prospectors uncovered great deposits of auriferous gravel in the dry beds of prehistoric streams in the Valley of California. These discoveries led to the prompt development of hydraulic mining, defined under California law as mining by means of the application of water under pressure through a nozzle against a natural bank.

A number of these ancient river courses carrying gold-bearing gravel have now been traced. They cut athwart the existing valleys, and their V-shaped sections are in places exposed on the steep sides of the modern streams. Given such large deposits, sufficient water, a heavy enough grade—and hydraulic mining was an inevitable development.

Quite Simple in the Early Days

For many years the "hydraulicker" had things his own way. He was working in "the wild and woolly." He could move on, if he wanted to, as soon as he could see the smoke of a new neighbor. He did not have to trouble about the rights of others or worry over the restrictions imposed by community living. True, as more settlers moved in the chances for friction multiplied, but there still was plenty of room, and the hydraulicker back in the hills had for the farmer in the valley below the same lordly contempt that the cattle raiser entertained for the sheep herder. The hydraulicker was a true individualist.

Such freedom, however, was too good to last. The individualist has to give way before the march of civilization which brings with it community development—including cross-word puzzles and jazz marathons. In the early 70's trouble began to brew between the miners and the farmers whose lands were being ruined by the gravel deposits washed into the upper valleys by the hydraulickers and carried downstream by the annual freshets. Early in the 80's the farmers got the upper hand and through a Federal Court injunction imposed such restrictions on hydraulic mining as to put that industry practically out of business.

This blow was almost a knockout. For ten years hydraulic mining was paralyzed, until in 1893 the California Debris Commission was formed, with Congressional authority to modify the injunction by permitting hydraulic mining under certain definite restrictions. These restrictions ordinarily involve the construction of dams behind which the tailings or debris can be stored. This commission is composed of three officers of the U. S. Army Corps of Engineers and holds its monthly meetings in San Francisco.

So much for the past; it is to the future that we should devote most attention, interesting though the past may be.

Uncertainty of Water Supply a Factor

Under the California Debris Commission a certain amount of hydraulic mining has been done by agencies with sufficient capital to meet the federal requirements covering storage of tailings, but operations have been spasmodic and on a small scale, due in part, it should be noted, to the fact that much depends upon the uncertainty of the annual snowfall and the subsequent runoff from season to season.

This uncertainty of the water supply plays a part in retarding hydraulic mining today; but a more serious obstacle to progress is not far to seek. All mining engineers who have come in contact with river problems can appreciate the difficulty involved in trying to harmonize the conflicting aims and ambitions of the three groups interested in irrigation, flood control, and power development. All of these factors exist in the situation faced by the California Debris Commission; in addition, there is the complication of gold recovery and channel maintenance in the lower river reaches.

If the amount of gold left to be recovered were small, there would be no great difficulty on this score. Channels for commerce would not be threatened, and central California could in time work out a logical solution of the customary three-cornered "flood control-irrigation-power development" problem. But much gold-bearing gravel still remains to be washed; it exists in such quantity and quality as to constitute a standing temptation to go on with hydraulic mining on a large scale. In one ridge alone washings in past years of 30,000,000 cu.yd. indicate that 800,000,000 cu.yd. remain, carrying an average of 12c. per yard. Say, $96,000,000 in sight for the men who can swing the deal!

Naturally, the thought arises as to why the hydraulic miner cannot bring the power-development interests and the agriculturists into line. If this could be done, these two agencies could contribute to the cost of the required impounding dams in accordance with the benefit each might expect to receive from the stored

water during the years required for the mining debris to move downstream into the reservoirs.

The solution would be a combination of capital, a cooperation of effort, and a proportionate distribution of the resulting benefits. But, so far, no agency has appeared in the hydraulic mining field capable of bringing about such harmony. It seems to be strictly against Western psychology to work in combination. Individualism is still strong, and a good fight is too much enjoyed to risk missing.

Authorization for Government Participation

The outlook for recovering the gold would be dark if it were not for the fact that under the law creating the California Debris Commission the Federal Government is explicitly authorized to participate in hydraulic mining operations. The language of the law is as follows:

"Sec. 25.—That said commission, in order that such material as is now or may hereafter be lodged in the tributaries of the Sacramento and San Joaquin river systems resulting from mining operations, natural erosion, or other causes, shall be prevented from injuring the said navigable rivers or such of the tributaries of either as may be navigable and the land adjacent thereto, is hereby directed and empowered, when appropriations are made therefor by law, or sufficient money is deposited for that purpose in said debris fund, to build at such points above the head of navigation in said rivers and on the main tributaries thereof, or branches of such tributaries, or at any place adjacent to the same, which in the judgment of said commission will effect said object (the same to be of such material as will insure safety and permanency), such restraining or impounding dams and settling reservoirs, with such canals, locks, or other works adapted and required to complete the same.

"Sec. 23. That upon construction by the said commission of dams or other works for the detention of debris from hydraulic mines and the issuing of the order provided for in this act to any individual, company, or corporation to work any mine or mines by hydraulic process, the individual, company, or corporation operating thereunder working any mine or mines by hydraulic process, the debris from which flows into or is in whole or in part restrained by such dams or other works erected by said commission, shall pay a tax of three per centum on the gross proceeds of his, their, or its mine so worked; which tax of three per centum shall be ascertained and paid in accordance with regulations to be adopted by the Secretary of the Treasury. . . ."

There is no getting around the fact that the original framers of the act of 1893 had in mined the probability of our government's being compelled to take a direct hand in unraveling the hydraulic mining tangle. Legal phraseology is seldom so clear and explicit. This fact is clearly recognized by the commission and others familiar with the law. To date, though, the commission has gone no farther than to supervise the efforts of corporations and individuals engaged in gold recovery operations, including the few combined mining-irrigation-power development projects that have gone through successfully.

Doubtless the main reason for this course is a disinclination to involve the Federal Government in what by tradition, if not by right, is a field for private capital only.

"Keep the government out of business," has been a very popular slogan; but, in my unofficial, personal opinion, here is a case where the paternal interest and partial participation of Uncle Sam seems to provide the best way out of the difficulty. Here is where the United States Government may have to go into business—if the gold is ever to be recovered.

This does not mean that the government would actively enter the hydraulic mining field in competition with private interests, but it does mean, in my opinion, that federal money should provide a revolving fund for the erection of impounding dams, the cost of which could be met by payment for storage of tailings created by hydraulic operators. In one instance a charge of 3c. per cubic yard has been fixed by a power-development company which has constructed a dam with the idea of assigning part of the reservoir for debris storage from anticipated hydraulic mining. If such federally built impounding dams were wisely located, it is hardly likely that private capital would fail to accept the challenge and take up again the quest for the gold that is known to lie waiting recovery. If, however, private interests did not respond satisfactorily, the government could as a last resort seek reimbursement by going actively into the hydraulic mining venture itself.

Government aid for hydraulic mining would of course have to run the usual gauntlet of criticism from those who are opposed to such policy. A good case can be made for the opposition, but we should not lose sight of the fact that like criticism, if heeded, would have denied our nation the great commercial boon of the Panama Canal, built and operated at federal expense.

Now gold, whether by the $100 or the $100,000,000, is a natural resource that is valueless so long as it remains in the ground. The gold in the gravels of central California must be recovered if this country is to benefit from it.

If this gold is to be recovered, now is the time to be about it, for as the population of the valleys increases, the irrigation and power-development factors will both increase in importance and complexity; and the gold recovery will be rendered that much more difficult.

Shall the United States go into partnership with hydraulic mining interests? There are many who believe that that time has come.

Production of Aluminum in 1924

The new aluminum produced in the United States in 1924 had a value of $37,607,000, which is an increase of almost one-third over the value of the output in 1923, according to a statement prepared by James M. Hill, of the U. S. Geological Survey. Aluminum of 99 per cent grade was quoted at 27c. a pound during the first week in January, but the price rose to 28c. and remained stationary until the middle of March. During April, May, June, and July the price was 28 to 29c., but in August it was 28c., where it remained until the end of the year. The price of metal of 98 per cent grade was steadily one cent under that of the purer metal. The domestic demand for aluminum, much of it for automobile parts, was somewhat less in 1924 than in 1923, as the production of automobiles was smaller and some manufacturers are now using pressed steel instead of the higher-priced aluminum.

The imports of aluminum in 1924 were nearly one-third less than in 1923, whereas the exports in 1924 increased 25 per cent over those in 1923. The total imports in 1924 amounted to 30,588,525 lb., which comprised 29,394,155 lb. of crude metal from scrap and alloy, 790,130 lb. of manufactured plates, sheets, and bars, and 404,240 lb. of hollow ware. The total exports amounted to 13,126,752 lb.

The Miner and the Faulted Vein

Practical and Theoretical Considerations Involved in Solving a Fault

By C. W. Hall

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C. W. Hall

THAT faults have played an important and indispensable rôle in the formation of orebodies is probably appreciated by all. Faulting, however, from the point of view of the miner, is usually considered as something likely to furnish a basis for confusion and bewilderment in the development of orebodies, or possibly the termination of a profitable mining enterprise. A promising vein and consequently a potential mining operation may be so intricately involved by faulting that the future is obscure. Many mines in the course of their history have proceeded to a point when a continuation of operations depended upon the solution of a faulting problem; and, indeed, there are few that do not have to deal, at some time, with this important geological feature. In view of its practical importance, the miner should be familiar with at least some of the simpler phases of the phenomena.

It is not an unusual procedure for a miner when he finds that his vein has been terminated by a probable fault to crosscut at random, first to one wall, and then, if nothing is found, to crosscut to the opposite wall. This method, though it accomplishes the desired purpose in many cases, often results in loss of valuable time and the incurring of expense which might be avoided if the problem of faulting were better understood.

Faulting May Be Simple or Complex

Few go so far as to lay down definite rules to be applied to faulting in general; the majority, appreciating the infinite possibilities, confine themselves to an admonishment that each case be accepted and worked out on its own merits, after collection and analysis of all available data; and that it always be remembered that fault-movement may be up, down, or in any conceivable direction.

Although a faulting problem may often be complicated, it is not always so, and a miner may frequently solve his problem not because of special geological wisdom but for the reason that it was really very simple.

This paper is intended merely to bring to the attention of the miner some of the less intricate phases of faulting, and to discuss certain features often encountered in practice which are of particular importance when a problem in displacement is being considered. The method of analysis is illustrated by diagrams and is, to some extent, a combination of descriptive geometry and trigonometry.

Granting the importance of faulting, and that his mining operation may sooner or later become involved in its complexities, just what is the miner to do when in following the course of his vein he finds it suddenly terminated against a blank wall, or sees that it is pinched out by a plane under conditions that may cause him to suspect that there has been a displacement?

The first thing that should be done (and it usually is, because it is the natural thing to do) upon finding that a vein has been apparently displaced is to cut through the fault plane, or zone, and explore beyond, for the vein may not in reality be displaced, but may contain a roll which tends to obscure it at that point, and further exploration may encounter the vein; or the fault may be so small in magnitude that the vein will have been displaced very little, and a slight extension of the drift may pick up the missing sector. Exploration beyond the fault should also give information as to any change in the rock formation, which might assist in proving a theory of displacement. However, if the general formation is homogeneous, little can be interpreted by a comparison of the rock on each side of the fault.

Evidence from Development Work

If it can be determined that a vein has been definitely displaced, it is well to drift a short distance along the fault for the purpose of getting a better idea of its strike and dip, and for a study of other important evidence such as fault striæ, drag, vein distortion, brecciation, mineralization similar in character to that of the vein, or any other data which might throw light upon the relative ages of the vein and the fault. Although a fault with its usual enveloping sheath of gouge may in some instances present an impermeable barrier to the entry of mineralizing solutions, this is not by any means the rule, and a fault should be considered with the possibility of its having been premineral as well as post-mineral—something that is not easily determined in many cases. A fault may have been later than the formation of the vein fracture but earlier than mineralization, late local movements and oxidizing agencies having acted in such a way as to cause a simulation of a post-mineral fault. These same agencies may also tend to destroy drag or other evidence of pre-mineral faulting. Again, a vein or orebody may terminate so that a late fault-movement would lend to the appearance of a post-mineral dislocation, when, actually, there could be no hope of further orebodies beyond—in so far as displacement is concerned. This condition is common in the shallow Tertiary deposits which do not have great extent in length or depth, but are made up of a series of more or less parallel, disconnected veins or stringers showing similar mineralization and perhaps offsets at

irregular intervals. What appears to be a sharp shearing of a vein by a presumptive fault is not necessarily definite evidence of post-mineral dislocation, for this may be caused by movements confined to the vein itself and resulting so that shearing is indicated. Often a fault which has displaced a vein is later the recipient of a mineralization peculiar to itself. Care must be exercised in deciding relative ages.

A fault which is ostensibly the cause of a vein displacement may be a later phase of an earlier series of complex movements, developed in such a manner as to obscure the original dislocating factors, and exploration for the lost vein based on the premise that the visible fault was the cause of the dislocation would come to naught. I am familiar with a case about as stated, where after a great deal of exploration, with heavy expenditure, it was determined that other factors were involved which threw an entirely different aspect upon further expectations.

Conditions Sometimes Deceptive

Where a vein has been intersected by a fault of nearly the same dip, and at a slight angle, it may be difficult to determine whether the vein has been displaced or has undergone a change in strike (which is common), with a reduction in width. In such a case if the work is not in the hands of one who understands the peculiarities of faulting, the fault plane might be followed with no other thought than that it is the vein, and the conclusion finally reached, from lack of extant mineralization and vein characteristics, that the orebody has pinched out and the place abandoned; whereas in reality there might be a dislocation of the orebody, and recognition of the fact, with intelligently directed exploration, should recover the vein extension. I know of a practical example quite similar to this, except that the fault plane had been followed, fortunately, for a sufficient distance to intercept the displaced portion of the vein; after which it was concluded that the fault represented a constricted, unmineralized part of the vein with a slight variation in dip, which was a common characteristic at other points. In this instance no harm was done and no one was, at the time, the wiser. If, however, the vein had been thrown in the opposite direction, things might have turned out differently.

A fault is usually considered as a plane of no thickness, but this is not always true in practice, for a vein may be suddenly terminated by a fault which is represented by nothing more than a wide zone of brecciation, and any amount of work will fail to disclose a definite plane. In such an instance the problem of locating the missing sector may be complicated, and exploration may of necessity be direct—more or less blindly. This condition should suggest other movements, the effect of which is visible, but of which direct evidence is lacking.

It is possible where a vein has been formed by mineralization of a fault fissure and has undergone displacement, that later movement along the vein will in turn offset the fault and obliterate important evidence of the original displacement. This possibility should be guarded against.

It is always well to crosscut where an orebody has been abruptly terminated, even though the fissure apparently continues. A crosscut may discover evidence of an unsuspected dislocation.

In searching for evidence with regard to a fault-movement it will be an aid to determine, by a projection on the dip, if the fault has been, or should have been, intersected on some other level of the mine, which may have reached the proper point. If it should have been intersected, and has not, then the existence of another or other faults should be suspected; although a change in dip is always a possibility. Two faults dipping in opposite directions, one displacing the other and both having had to do with a vein dislocation, are not uncommon, and confusion will ensue if the fact is not discovered in time. This condition might leave the vein broken into more than two sectors; that is, there might be a short length between the two main portions, displaced by the later fault, and after discovery of the middle section exploration would necessarily be continued in search of the main faulted portion.

Surface detail is valuable in collecting data on displacement. Though a fault may not be directly visible on the surface, its existence may be inferred from a brecciated zone, by saddles, scarps, troughs, or ridges, or by abrupt changes in the topography. A detailed survey along with maps in plan and section will greatly aid in bringing out and correlating data that may be necessary for a complete solution of the problem. Securing such data will likely lead far afield from the mine workings. Notes on rock formations of sedimentary strata, volcanic tuffs, beds, dikes or sills will be of prime importance, for from a study of such formations will likely come evidence that may materially aid in the calculation of the magnitude of the displacement. If the faulted and unfaulted positions of two strata or the faulted and unfaulted positions of one stratum, with the direction of movement, can be found, which are common to the fault in question, the functions of the fault-movement can be calculated and the displacement of the vein solved.

A problem involving displacement of an orebody which is confined to a rock formation of homogeneous character may prove insolvable, and it might be necessary, because of the paucity of details, to direct exploration on assumed data, which, though uncertain, offers the only alternative, and if intelligently carried out may result satisfactorily.

The direction of movement is important and is often among the most easily obtained data. It can sometimes be approximated by a study of the striæ on the fault plane, although striæ alone may be unsafe evidence upon which to predicate a theory of direction of movement. Even if this function is the only one which can be determined, development can proceed with reasonable expectation of discovering the lost portion of the orebody, although the amount of work necessary to do this cannot be definitely reckoned.

For illustrating a method of interpreting fault-movement the accompanying sketches will be discussed.

Fig. 1 is a horizontal projection or plan. *OV* represents the trace of a vein with a dip of *a*, intersected at *O* by a fault *FF*, with a dip of *b*. By projecting both the vein and the fault on their respective dips to an imaginary level below, say *n* level, *BVn* will represent the *n* level contour of the vein trace and *FnFn* the *n* level projection of the fault trace. The line *II* drawn through the trace intersections of the upper and lower level will then be the trace of the intersection of the vein and the fault. *DE* is a construction line drawn for the purpose of solving the various triangles.

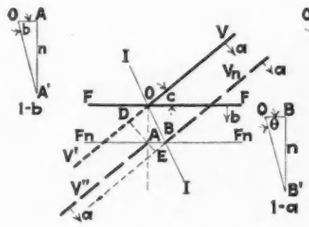


Fig. 1

OA' = Total displacement
Zero = Horizontal displacement
AA' = Normal throw
OA = Horizontal throw
AB = Total heave

Formula for Fig. 1

$$H = n\left[\cot b \tan d + \left(\frac{\cot a - \cot b \cos c}{\sin c}\right)\right]$$

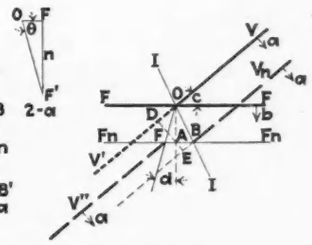


Fig. 2

OF' = Total displacement
AF = Horizontal displacement
AA' = Normal throw
OA = Horizontal throw
FB = Total heave

Formula for Fig. 2

$$H = n\left[\cot b \tan d + \left(\frac{\cot a - \cot b \cos c}{\sin c}\right)\right]$$

The fault-movement is assumed in this case to be normal; that is, the hanging-wall side moves down and perpendicular to the strike, or parallel to the dip of the fault. Consider the vein OV (represented by VOV' before displacement has taken place) at the time of intersection by the fault FF; then OV', the sector of the vein to the hanging wall of the fault, is displaced; the vein breaks and along with the enclosing formation moves down, a point on the vein at O travels downward over the line OA' (Fig. 1-b), projected on the plan as OA, and comes to rest after a normal throw of n (assumed in this case to be the vertical distance to n level) at A', the projection of which is A on the plan; then the faulted portion of the vein OV' takes up its new position as AV'', which is the vein trace. Now the unfaulted portion of the vein OV projected on its dip of a will appear at n level as BVn, for its extent is confined from the point B on the line of intersection of the fault and vein, and it can extend only to the footwall of the fault. After the displacement the separated sectors of the vein are represented on n level by the hanging-wall portion AV'' and the footwall portion BVn, having suffered a total heave of AB. It will be noted that the displacement has left a gap between the severed portions of the vein. The functions of the fault-movement are named[1] under the figure. A drift on n level being driven along the vein AV'' upon intersecting the fault at A would be expected to encounter the missing sector by following the fault from A to B, the shortest distance in this case. However, instead of drifting along the fault plane it is always best to cut through the fault zone a sufficient distance to get away from the influence of the movement and crushing effect, and drift parallel to it. The rock formation in close proximity to a fault is often much brecciated and altered and, in some cases, mineralized by solutions after dislocation; all of which would tend to obscure the vein at the junction with the fault, where it might very easiliy be missed.

Fig. 2 is a graphical representation of the same case as Fig. 1, except that from the striæ visible on the fault plane it has been determined that the movement was not parallel to the dip, but at an angle of d (see the illustration) from it; then when OV', the sector of the vein to the hanging wall of the fault, is displaced, a point on the vein at O breaks and follows down the fault plane over the line OF' (Fig. 2-a), coming to rest after a normal throw of n at F', projected on the plan as F, and assumes its new position of FV'' on n level; in which case the total heave is FB instead of AB as in Fig. 1. The direction of exploration for locating the faulted sector of the vein would be the same as in Case 1, except that, owing to the direction of the movement, the displacement has resulted in a greater heave and a consequent longer gap.

Fig. 3 is the same as Fig. 2 but for the direction of movement, which has been over a line OG (OG' on the section Fig. 3-a) and the sector of the vein to the hanging wall of the fault takes up the position of GV'' after a normal throw of n, when the total heave is BG. The displacement has caused an overlap of the vein sectors instead of a gap as in Figs. 1 and 2. A drift along the vein GV'' on n level upon loosing the vein at G would be directed through the fault zone and then as a crosscut to the footwall, at right angles to the vein.

In Fig. 4 a case is taken where the angle of intersection of the fault and the vein is small; movement is assumed to be down, and parallel to the dip of the fault plane, as in Fig. 1; then OV, the displaced sector of the vein, after a normal throw of n, comes to rest at n level as AV''; a point on the vein broken from O having moved down over the line OA' (Fig. 4-a), the footwall sector remaining, as before, at n level as BVn. The displacement has caused a heave of AB and a long overlap of the two portions of the faulted vein. Exploration for the missing sector would be directed as in Fig. 3, always remembering to cut through the fault zone before crosscutting.

In Fig. 5 the construction is the same as in the former cases, but the strike and dip of the fault and vein have been varied for the purpose of illustration. The normal throw is taken as n and the direction of movement is assumed to be down and parallel to the dip of the fault; that is, a point on the faulted portion of the vein at O breaks and moves down the fault plane over the line OA' (Fig. 5-a) and comes to rest at A', shown as A on the plan, when the faulted sector assumes the position, after a normal throw of n, of AV''. Owing to the flat dip of the line of intersection II, of the vein and the fault, the displacement has resulted in a long gap between the faulted and unfaulted sectors of the vein. Exploration for the displaced part would be directed as in cases 1 and 2.

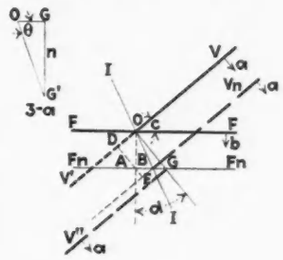


Fig. 3

OG' = Total displacement
AG = Horizontal displacement
AA' = Normal throw
BG = Total heave
OA = Horizontal throw

Formula for Fig. 3

$$H = n\left[\cot b \tan d - \left(\frac{\cot a - \cot b \cos c}{\sin c}\right)\right]$$

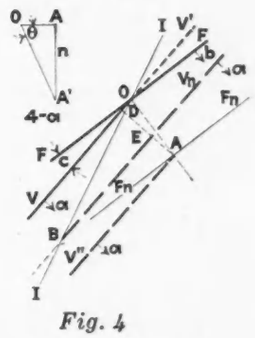


Fig. 4

OA' = Total displacement
Zero = Horizontal displacement
AA' = Normal throw
AB = Total heave
OA = Horizontal throw

Formula for Fig. 4

$$H = n\left[\cot b \tan d + \left(\frac{\cot b \cos c - \cot a}{\sin c}\right)\right]$$

[1] *Nomenclature by Tolman.*

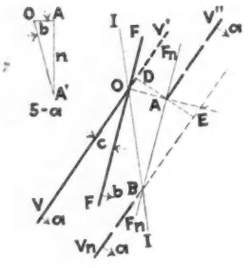


Fig. 5

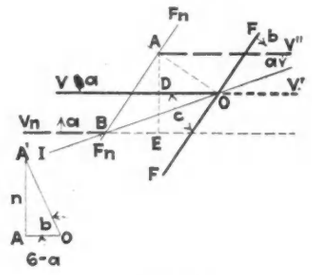


Fig. 6

OA' = Total displacement
Zero = Horizontal displacement
AA' = Normal throw
OA = Horizontal throw
AB = Total heave

OA' = Total displacement
Zero = Horizontal displacement
AA' = Normal throw
OA = Horizontal throw
AB = Total heave

Formula for Fig. 5

$$H = n\left[\cot b \tan d + \left(\frac{\cot a - \cot b \cos c}{\sin c}\right)\right]$$

Formula for Fig. 6

$$H = n\left[\cot b \tan d + \left(\frac{\cot a + \cot b \cos c}{\sin c}\right)\right]$$

Fig. 6 represents a fault of the reverse order, where the movement of the hanging wall has been up with reference to the footwall. The direction of movement has been assumed to be over the line OA' (Fig. 6-a), or OA on the plan, which is normal to the strike of the fault. Construction differs from the former cases in that the vein and fault traces have been projected up to n level above, instead of below. OV' represents the segment of the vein to the hanging wall of the fault before displacement. II, as before, is the trace of the line of intersection of the vein and the fault. At the time of displacement a point on the vein at O breaks and moves up the fault plane over the line OA', coming to rest at A' or A on the plan, after a normal throw of n, when OV' takes the position at n level of AV''; the footwall portion of the vein projected up on its dip appears at n level as BVn. Thus the displacement has caused a total heave of AB, and a drift along the vein BVn should, at the point B, be turned to the hanging wall and directed parallel to the fault for intersection with the vein extension at A.

Fig. 7 represents a problem where the direction of the fault-movement has been parallel to the trace of the faulted vein on the fault plane, in which case there can be no heave and consequently no practical solution for the miner to make, unless it be for the purpose of explaining a sudden change in the vein characteristics at a given horizon, which might be accounted for by a displacement of this nature. II is the trace of intersection, and its strike represents the direction of movement. The hanging-wall sector of the vein breaks at O, carrying a point down the fault plane over a line, the horizontal projection of which is II, when the faulted portion of the vein after a normal throw of n comes to rest as BV'' on n level; BVn is the portion of the vein to the footwall of the fault at that level, so there is no heave.

In solving for the various functions of the fault-movement perhaps the easier way is by methods of descriptive geometry.[2] The same results may be arrived at by a simple solution of triangles, trigonometrically.

The following formula will hold for any case of faulting (except rotation about a pole), whether normal or reverse, with a change of algebraic signs to fit each problem:

$$H = n\left[\pm \cot b \tan d \pm \left(\frac{\cot a \pm \cot b \cos c}{\sin c}\right)\right]$$

in which

H = Total heave
b = Angle of dip of fault
n = Normal throw
d = Angle of direction of movement
a = Angle of dip of the vein
c = Angle of intersection of the fault and the vein.

It will be understood that to solve for H, the total heave, n the normal throw, or other functions, such as the total displacement, and d, the direction of movement, must be determined from other sources, or vice versa, in solving for n or d. The other functions of the formula can nearly always be measured directly from the problem in hand.

The formula presented in the preceding paragraph as applied to the cases illustrated is given under each figure. In all cases where the direction of movement is normal to the strike of the fault, then $d = 0$ and the first term of the formula drops out. In the case of Fig. 1 the striæ on the fault plane would be parallel to the dip. In arriving at d, the direction of movement, we will take a case such as in Fig. 2 where the striæ on the fault plane subtend an angle of, say, e with a line normal to the strike of the fault, which can be measured with a Brunton; then for the horizontal projection of e, which is called d in the formula, $\tan d = \frac{\tan e}{\cos b}$, in which e and d are as stated and b is the angle of dip of the fault.

If enough data can be collected to calculate n from the general formula, then the other functions of the fault-movement may be easily determined—

Total Displacement (Figs. 1 and 1-b) $= OA' = \frac{n}{\sin b} = OF'$ (Figs. 2 and 2-a) $= \frac{n}{\sin \theta}$,

in which θ is calculated from the general dip formula, $\tan \theta = \cos d \tan b$, which formula may be used to determine the dip of the line of intersection (II) of the vein and the fault, Fig. 1-a. This is often of practical value where it has been discovered that a vein has been faulted on one level and it is desired to ascertain to what points on other levels the orebody may be expected to extend. The strike of this line of intersection (II) can be calculated by solving for the angle AOB, Fig. 1.

If it is not desired to go to the trouble of applying the general formula given above to each particular faulting problem, the same result may be arrived at by solving triangles of a sketch drawn from data in hand.

It is always better to analyze each problem on its own possibilities by simply representing it graphically by the method shown, and then by solving for the functions, than to depend upon any rule of thumb for

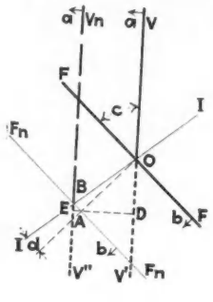


Fig. 7

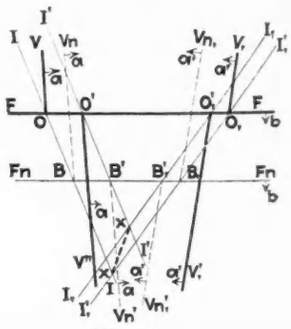


Fig. 8

[2]See "Graphical Solution of Fault Problems," by C. F. Tolman, Jr.

determining the side to which a vein may be thrown. No rule will hold except for a very few cases, and an attempt to apply one to any definite problem will more than likely result in confusion and loss of time. Though it is necessary to have certain data before much can be done toward a complete solution of a displacement, if nothing more than the direction of movement can be approximated, the side to which the vein has been thrown may be determined by applying the principle given in the foregoing, and exploration can proceed with reasonable hopes of success; in which case development may be more intelligently controlled by substituting values for the fault-movement and determining the length of, say, a unit of crosscut which would correspond to a unit function of the magnitude. For example, in Fig. 1 a drift along the vein *BVn* having lost the vein at *B* should be directed (knowing nothing but the direction of fault-movement) along the hanging wall of the fault *FnFn* from *B* in the direction of *A* for an unknown distance; then from the dip and strike of the fault and the vein, it is calculated (from the formula) that 100 ft. of crosscut will allow for 850 ft. of displacement, and if the extension of the vein is not intersected within a reasonable distance, it would naturally indicate that the fault was of immense magnitude or that something was wrong in the interpretation of the data. For this reason, among others, it should be obvious that the problem and data pertaining thereto must be considered with all possibilities in mind before beginning exploration.

Fig. 8 is a representation of a problem of solving for the direction of fault-movement when the faulted and unfaulted positions of two strata are known. *FF* is the trace of a fault plane with a dip of *b; OV* and *O'V'* are the traces of the faulted and unfaulted positions of one stratum with a dip of *a; O_1V_1* and *$O_1'V_1'$* are the traces of the faulted and unfaulted positions of another stratum, both common to the fault *FF*. As in the former cases, by the method of lower level projection, the traces of the intersections of the fault and faulted strata are constructed; being *II*, *I'I'*, *I_1I_1* and *$I_1'I_1'$*. These traces are projected in length to intersect at *xx;* then the trace *xx* gives the direction of movement, and the angle which it makes with a line normal to the strike of the fault is the angle wanted (*d* in the formula). With this direction of movement and the heave, which can be measured directly, any solution will be the same as Figs. 2 and 3.

Better to demonstrate the application of the method of interpreting fault-movement above given, a problem will be stated and the case applied:

Given the strike and dip and positions of both sectors of a faulted vein or stratum, the strike and dip of the fault, and the direction of movement, to find the normal throw. With this data the heave can be measured directly; then in Fig. 2; which may be used to represent the problem as stated, consider the vein (or stratum) *VOV'* at the time of displacement by the fault *FF*, when a point on the vein at *O*, along with the hanging wall of the fault, moves down, the point broken at *O* traveling downward on the fault plane over the line *OF''* (Fig. 2-a), shown as *OF* on the plan, and comes to rest after a total heave of *FB*—that is, when the distance between the two portions of the vein at the same level is equal to *FB*. In the original discussion of Fig. 2 the faulted part of the vein *OV* came to rest as *FV''* after a normal throw of *n;* in this case the throw is not known, but the movement is worked out from the heave. When *O* has reached the point *F'* (*F* on the plan), the hanging-wall sector of the vein takes up the new position of *FV''*. Then from the formula under Fig. 2, *n*, the normal throw, can be calculated, and from this the total displacement and other functions of the movement which may be desired; or if it is preferred to solve the problem by method of descriptive geometry this can be done by revolving the fault plane into the horizontal and the measurements taken graphically.

It will be an aid in the search for data on a particular fault-movement to compare it to other faults of the district, the magnitude of which are known. For instance, if it is known that the faults are usually of small displacement, of, say, a few hundred feet or less, or perhaps a maximum of a thousand feet, then there is little reason for assuming that any other fault within the district would be of much greater displacement, although this should not be an invariable rule.

Many faulting problems may be insolvable, and others require the study of a specialist, but it is not always necessary for the miner to call in an expert, for by applying a certain amount of study and with the use of good judgment he may be able to work out his own problem satisfactorily.

Rhodesian Mining Industry Improved Last Year

According to a report of Vice-consul A. H. Cawston, of Johannesburg, published in *Commerce Reports*, of the U. S. Department of Commerce, the most important mineral produced in northern Rhodesia continues to be lead. The output in 1924 amounted to 6,621 tons, valued at approximately £100,000—representing three-quarters of the value of the total mineral production of northern Rhodesia. Small quantities of gold, silver, and copper were produced during 1924.

The outlook for the future production of copper, however, appears to be very promising. Three large companies—the Bwana M'Kubwa Copper Mining Co., the Rhodesian Congo Border Concession, Ltd., and the Rhodesia Minerals Concession, Ltd.—are doing exploration work, and important discoveries of copper ore has been made on their properties. Large mining concessions have been obtained by these companies.

The total value of the mineral production in southern Rhodesia during 1924 amounted to £4,478,000, compared with £4,300,000 in 1923 and £4,474,000 in 1922. Gold was the leading mineral, as usual, 627,729 oz., valued at £2,939,562, having been produced. Silver production amounted to 166,472 oz., valued at £22,488. Base metals and precious stones accounted for £1,516,000. Of the base metals, chrome ore shows the greatest increase over 1923, amounting to 172,000 tons in 1924. The asbestos production increased to 26,000 tons in 1924, but copper declined to 2,826 tons.

Although no great records were established in southern Rhodesia during 1924, the position of mining in the colony is satisfactory. A number of new deposits of gold and copper ore were discovered, and their development is being planned. In view of the interest in gold- and copper-mining companies, it seems likely that the production of these commodities will be considerably increased in 1925. The development of asbestos and chrome-ore deposits is also commanding more attention.

Useful Operating Ideas

A Proposed Ore-caving Method

By James E. Harding
Casilla "B," Antofagasta, Chile, South America

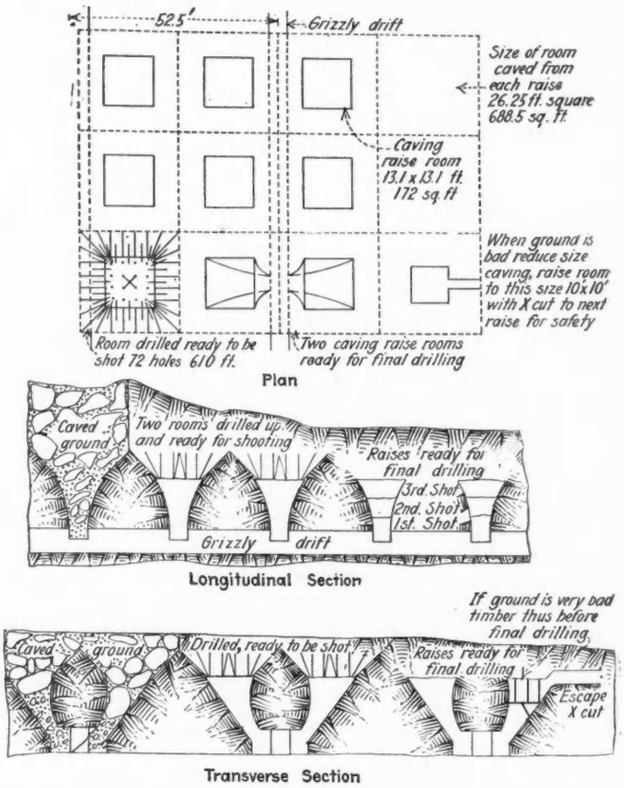
The method of caving large copper orebodies, as at present applied, is a development or outgrowth of a system which was first, I believe, applied in the iron mines of the Lake country. In copper mining caving began as block caving, from which developed the Ohio caving, or branched-raise method, and then the Inspiration system, which is the latest and probably the best exemplification to date. The development of ore caving has tended to cheapen the cost of getting the ore into cars and on its way to the mill, has brought about the caving result with fewer workings, and has resulted in attempts to prevent the mingling of ore with waste as it is drawn into cars.

As at present in operation, the method seems to be capable of improvement along the same lines which have been indicated in the past. Apparently, additional workings can be avoided and perhaps the general operation of the system improved. The uppermost workings at present are the undercut level, on which parallel drifts are run on centers 25 ft. apart, more or less, and the pillars between these drifts are blasted out by working from the drifts, causing the superincumbent ore to cave. Immediately below the undercutting level is the grizzly level, also consisting of parallel drifts, twice as far apart as those of the undercutting level. Longitudinally along the grizzly drifts are established the grizzlies through which the broken ore is passed down raises to cars on a haulage level beneath.

Between the grizzly and undercutting levels branch raises are extended which start at the grizzly and by various branches reach the undercutting level. Through these raises, assisted by the force of gravity as well as by blasting, bulldozing, and barring, the broken ore is caused to flow from the caving mass above.

About 50 per cent of the cost of caving operations is expended above the grizzly level, and it is hoped that the system herein suggested will reduce this cost somewhat and possibly result in a cheaper and better system. Briefly, the new method does away altogether with the undercutting level as such and performs all the work of caving from raises extended up from the grizzly level. Just what may have been done in the past in this respect I do not know, but it is at least not now standard practice.

It will be necessary for the working out of the system to run parallel grizzly drifts, as is the usual practice in caving. A suitable distance one from the other would be about 50 ft. After driving the grizzly levels and placing the grizzlies over the raises connecting with the haulage level below, the first procedure is to blast out a crosscut round, without back holes, on each side of the drift. The purpose of this is to enable the undercutting raises to be offset from the grizzly and to avoid ripping out the back of the drift, unduly enlarging its size and making timbering necessary. From these short crosscuts the raises are then started about 4 ft. square and on an incline of 45 deg.; see first, second, and third rounds in the longitudinal section of the accompanying illustration. The footwall slope is maintained for the three rounds, but the other three walls of the raise are extended on an ever-increasing slant until at a height of 15 ft. above the grizzly level each raise is approximately 13 ft. square. This operation finishes the raising, and the raise is then ready for the final drilling and caving.



A proposed system of undercutting in which the work is done entirely from raises, completely dispensing with undercutting level and drifts

On the plan shown in the illustration it will be observed that the undercutting area has been laid out in squares 26.25 ft. on each side, and that each of the enlarged raises is underneath the center point of each square. In the lower left-hand corner of the plan the drilling plan for the caving operation is detailed. This drilling plan is predicated on hard rock, and can be considerably modified when the rock breaks easily. By this method, as room after room is blasted, the entire undercut is completed.

In the description no mention has been made of applying the method in bad ground and the avoidance of danger. For example, if it should be dangerous to drive the raise to a 13-ft. square section at the top, the square can be reduced to approximately 10 ft. and the caving drilling still accomplished. In case of very bad ground, a small pilot raise, 4 ft. square, can be

extended to the desired height, a room cut out around the top, and the back and the walls of the lower raise drilled for enlargement. All holes could then be blasted. Timbering can also be put in, as indicated in the transverse section, if it is necessary to support the back while the final drilling is being done. If it is considered necessary to have communication from one raise to another, a crosscut 13 ft. long will accomplish this purpose. However, the contentions that this system might be dangerous are not impressive.

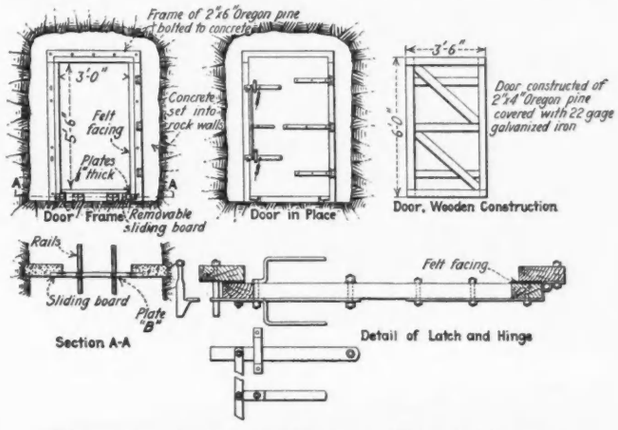
If the system can be made to work, it would have advantages in both the driving of workings and later in getting out ore, for the following reasons: All work is done from the grizzly level, where it can be more easily supervised; the undercut level, with all of its pipe lines and the transportation of all material to that level, will have been eliminated; raises are all alike and are extended by straightaway work; the work of caving is done by stoping drills, which drill faster and at lower cost; ground can be caved faster and with less preparation; workings do not have to be driven far in advance of caving; the tapered raises will choke close to the grizzly, and be therefore easier to clear; the pillars in this method, by opposing a sharp edge to the caving ground, will split the weight of the overlying mass so that great weight will not develop over small sections of the grizzly level and cause crushing of pillars.

It is planned to install air lines in all grizzly drifts and to use a type of paving breaker to break the rocks which stop on the grizzly, instead of breaking them by hand. By the use of such a machine it should be possible for one man to work a large daily tonnage through the grizzly without undue fatigue.

Construction of Mine Fire Door

A type of mine fire door, designed by Stanley L. Arnot, superintendent of the Plymouth mine, at Plymouth, Calif., is shown in the accompanying illustration. Doors are used in the Plymouth mine at every level, and the type shown has proved to be convenient and satisfactory for the purpose intended.

The door is constructed of 2x4-in. Oregon pine covered on both sides by 22-gage galvanized iron. It is swung by three hinges from a 2x6-in. outer frame, which in turn is bolted to a concrete partition keyed into the sides, top, and bottom of the drift. The hinges are bolted to the door and to the frame. The latch is arranged in two parts so as to hold the upper and lower parts of the door. It is operatable from either side. A removable sliding board is provided at the bottom. A felt facing is provided on the door and also on the door frame at the points of contact. This serves to make the door as nearly airtight as possible. The construction is light and fire-retardant.

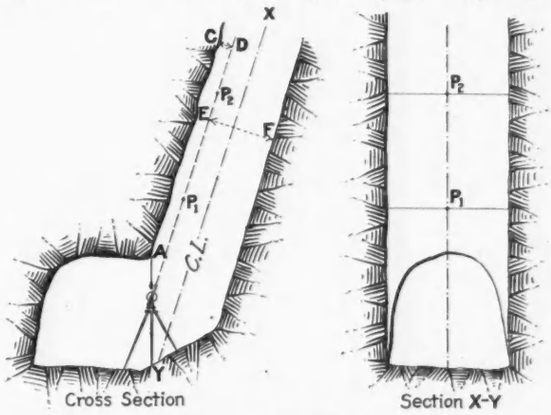


Mine fire door developed at Plymouth mine, Plymouth, Calif.

Method of Aligning Raises

By A. Manning

For several years I was chief engineer with the Santa Gertrudis Co., Ltd., Pachuca, Mexico, and in that capacity surveyed raises, winzes and shafts. In *Mining Journal-Press* of Feb. 7, 1925, on page 251, I noted with interest the method of aligning raises suggested by F. Montijo. In my opinion the distance between points indicating the direction is very short and there is danger of deviations in the raises unless the points are frequently rechecked for position as the raise is advanced.



Sketch showing a method of aligning raises

The following method is suggested as a means of avoiding the difficulty mentioned:

The transit is set up at *A*, shown in the accompanying figure, and, starting from the back-sight station, the direction and inclination angles are turned off. At a convenient distance the line of sight is bisected by a cord stretched from one side to the other of the raise, as at P_1. Wooden plugs are set in the walls of the raise and spads are set in position. At a distance of 5 or 6 ft. further up the raise another pair of plugs is similarly placed, as at P_2. The steel tape is stretched between the respective pairs of plugs and the distance corresponding to the line of sight is measured. In addition the distances *C-D* and *E-F*, respectively, between line of sight and hanging wall and footwall of the raise, are measured. All four measurements are given to the person directing the work.

Sectional Grizzly

At the Kennedy mine, near Jackson, Calif., a sectional grizzly is used in the crusher house. The grizzly is made in sections, four bars to a section. Each bar is 1x4 in. in section. The four bars are bolted together at four points, thimbles maintaining the proper distance between the bars. The sections can be changed end for end, back to front, or shifted to any division of the grizzly frame. Thus the bars can be subjected to maximum wear before replacement. The idea has proved to be practicable, and has resulted in greater economy than is possible in the use of the ordinary bars.

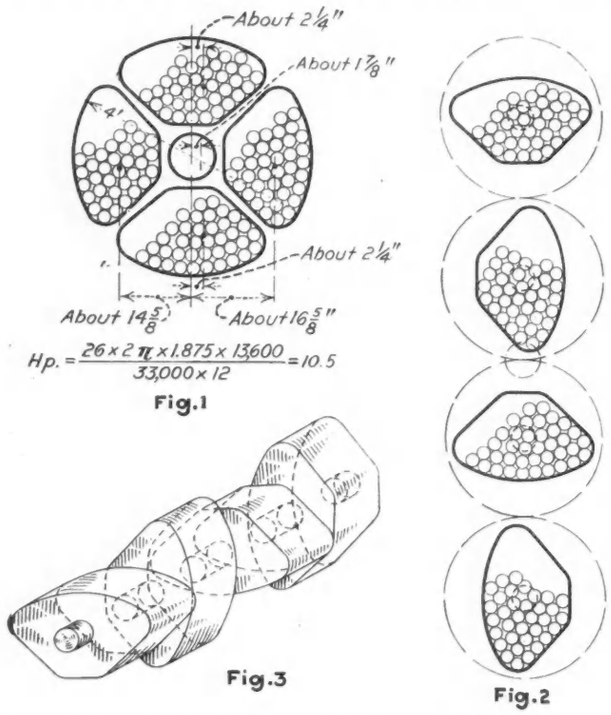
Discussion

Power Requirements of Ball Mills

THE EDITOR:

Sir—The article on power consumption in single- and multiple-compartment mills in your issue of Jan. 24 omitted the following facts:

My article of July 26, 1924, clearly showed that the center of gravity is nearer the geometric center in a multiple-compartment mill built about a common center than in a single-compartment mill of the same diameter. Such a fact has never been disputed. It was just as clearly shown that, other things being equal, the amount of useful work is directly proportional to the distance



Centers of gravity, ball arrangements, and compartment arrangements, in a multiple-compartment mill

from the geometric center to the center of gravity. The horsepower of work done is proportional to the horsepower put in.

Loading any mill above its center of gravity reduces the distance of the center of gravity from the geometric center, increases the load, and reduces the horsepower required. It also reduces the drop of the grinding media. If one increases the number of compartments sufficiently, or loads the mill high enough, the horsepower can be reduced to almost nothing, in which case one might as well use a launder instead of a mill. Horsepower, as compared to load, is directly proportional to the drop of the grinding media, regardless of the number of compartments. The three figures all have the same distance of center of gravity from the common center, the same horsepower requirement, the same load, and the same capacity for work.

Los Angeles, Calif. JOHN HERMAN.

Noblesse Oblige

THE EDITOR:

Sir—The title reflects the assumption that the heads of department who have furnished the U. S. Civil Service Commission with the memorandum of necessary qualifications of applicants for positions cited below are themselves college men. The positions are "engineers and assistant engineers, petroleum and natural gas," with the U. S. Bureau of Mines, as set forth in a circular issued Jan. 17, 1925, headed U. S. Civil Service Examination, and signed "Government Printing Office." Engineers must have received a college degree in petroleum, mining or civil engineering or geology, and have had five years of practical experience; or have had two years of this college training and seven years of practical experience. Assistant engineers must have received a college degree in petroleum, mining or civil engineering or geology and have had one year of practical experience or two years of college and three years of practical experience. The age limit is seventy years.

The circumstance recalls a similar circular from the commission of about April, 1920, for engineers as examiners of mines in the Bureau of Mines service, age limit sixty-five years. The requirements were contained in an accompanying circular signed by F. G. Cottrell, Director, and W. R. Crane, chief engineer. It called for a straight college degree, followed by a certain number of years of experience.

It should be gratifying to families devoting much self-denial to getting their boy into college to know that the shadow of a protecting hand may shield him from outside competition in at least some government positions for the next, say forty-five years. The last circular has practically reduced the college attendance requisite from four to two years. If this were again halved, it would help further, as many drop out after the first year for very good reasons.

San Francisco, Calif. J. B. HASTINGS.

Actual Cost

THE EDITOR:

Sir—Referring to your issue of April 18, 1925, on page 657, apparently a Tonopah dispatch, entitled "Nevada Mine Operators to Fight Bullion Tax Ruling," there is a misstatement of fact in the last sentence of this dispatch, which reads:

"Under the ruling only the actual cost of bullion production may be deducted."

The matter in controversy between the mining interests and the Nevada Tax Commission is the meaning of the term "actual cost." The mining interests contend that actual costs means all direct costs, such as labor and supplies; also, indirect costs, such as depreciation, taxes, and insurance on all those elements which enter into production. The ruling of Judge Dunn is that actual costs constitute only direct costs and do not include depreciation, taxes, and insurance on the elements which are used in production.

Tonopah, Nev. JOHN G. KIRCHEN.

Consultation

Stope Contracting by Anaconda in Butte

"Can you tell me if the Anaconda Copper Mining Co. uses contracts in mining its stopes? Where may I obtain detailed information about this?"

Stope contracting has been practiced in the mines of the Anaconda Copper Mining Co., in Butte, Mont., since 1919. Full details of the system used may be found in a paper by C. L. Berrien, entitled "Stope Cost Records and Mine Contracts of the Anaconda Copper Mining Co.," published as part of the *Transactions* of the A.I.M.E. at its February, 1922, meeting. Work is done on a cubic-foot basis, the price per cubic foot being regulated by conditions such as the hardness of the ore or waste, width of the ore, method of stoping, accessibility, temperature, and humidity. The working places are measured each Wednesday by the engineering department, assisted by samplers and efficiency men, the work being checked by the foreman of the mine. Contracts are made for one week, at a set price, but may be terminated after one day by either the foreman or the contractors. The men are notified of the price on Thursday morning, which is the beginning of each contract week. According to Berrien, no change in the rate per foot is permitted during the life of the contract, but adjustments are made in special cases, which must be noted by both engineer and foreman. If any change in conditions arise during the week, making the price too favorable to the men and permitting them to earn too high a wage rate, the foreman terminates the contract and establishes a new rate. Likewise, if conditions unfavorable to the men arise, the rate is raised and a new constract started. Berrien says that these rules are enforced strictly for the purpose of preventing favoritism and seeing that the men receive a fair award.

It is claimed that the cost per ton of ore is less by contract and that the stope cost record and contract system have given a more accurate check on the cost of underground operations than any other method used by the company. Moreover, a direct check is given on the waste broken or tons of rock broken to obtain a ton of ore in each stope. When contracts are given, a list is posted at the mine, showing price per foot, and, when finished, full information of the results, giving contract number, working place, price per foot, total shifts, total money, and rate earned. Every man at the mine is paid weekly. Contractors with complaints may appeal to the general superintendent through the usual channels. As stated by Berrien, the method can be successful only by the most careful superintendence and absolute fairness to the employees.

Alaska's Tin Production Small

"Please tell me how much tin has been produced by Alaska. What type of deposits does it come from and what year yielded the largest output?"

Alaska produces only a very small amount of tin each year. From 1902 to 1922 inclusive the total amount of tin ore mined in Alaska, according to the reports of the U. S. Geological Survey, aggregated 1,609.3 tons, which contained 993.4 tons of metallic tin. The entire production was valued at $937,576. Compared with the large amount of tin mined in the Straits Settlements and in Bolivia, this production record is comparatively insignificant.

Alaskan tin is derived from placer or stream tin deposits. Often it is produced in the conduct of gold placer operations.

The year of greatest tin production was 1916, when 139 tons of metallic tin were produced in 232 tons of ore. A value of $121,000 was placed by the Survey upon this output. In that year and the one following tin prices all over the world were so extraordinarily high that tin production everywhere was stimulated. Even Alaska, with its little production, felt the influence of these high prices. On the contrary, when tin prices were low, as in 1921 and 1922, the tin output dropped sharply. Only 4 tons of metallic tin were produced in 1921 and 1.4 tons in 1922.

Utah Copper's Mining and Milling Costs

"Please give me some idea of what it costs Utah Copper Co. to mine and mill its ore. I have not seen any of the operating data in which I am interested published. What is Utah's cost of production per pound of copper produced and what is the tenor of the ore mined and treated?"

Utah Copper Co. has been very frank in furnishing the public with full details of its costs and financial condition. The following information has been taken from the 1924 annual report of the company and will answer officially the questions asked above:

During 1924 Utah Copper produced 223,990,197 lb. of copper in concentrates, precipitates, and scrap. The net output of refined metal was 214,592,733 lb.

Utah Copper milled an average of 33,406 tons of ore per day during 1924. The Magna plant handled 6,522,800 tons, and the Arthur plant, 5,603,800 tons. Utah Copper's ore is low grade and contains a little more than 21 lb. of copper per ton. In 1924 the average grade was 1.07 per cent; in 1923, 1.12 per cent. Of this metal content the mills recovered in 1924 about 85.9 per cent or 18.43 lb. of copper per ton, compared with 18.18 lb. per ton in 1923. The concentrate produced averaged 18.07 per cent copper in 1924.

Operating costs of mining, milling and ore delivery per ton since 1910 have been as follows. They include all fixed, general and maintenance charges:

Operating Costs of Utah Copper Co.

Year	Tonnages	Mining	Ore Delivery	Milling	Total
1910	4,340,245	$0.4097	$0.2978	$0.4663	$1.1738
1911	4,680,801	.4479	.3078	.4168	1.1725
1912	5,315,321	.4233	.2848	.4158	1.1239
1913	7,519,392	.3288	.2797	.3676	.9761
1914	6,470,166	.3232	.2782	.3536	.9550
1915	8,494,300	.2441	.2781	.3402	.8624
1916	13,994,000	.2781	.2792	.3782	.9355
1917	12,542,000	.4446	.2794	.6930	1.4179
1918	12,160,700	.5370	.2983	.9277	1.7630
1919	5,538,700	.4900	.3040	1.2062	2.0002
1920	5,556,800	.4823	.2591	1.2472	1.9886
1921	1,220,700	.4998	.1921	1.1679	1.8598
1922	4,364,251	.3833	.1612	.8417	1.3862
1923	11,167,800	.3488	.1088	.6116	1.0692
1924	12,126,600	.3605	.1308	.5990	1.0903

The average cost per net pound of copper, including depreciation of plant and equipment and all fixed and general expenses, and after crediting gold, silver, and miscellaneous earnings, was 8.89c. in 1924, as compared with 8.74c. for the preceding year, computed on the same basis. The value of the gold and silver recovered and the miscellaneous earnings amounted to 1.206c. per pound of copper, as compared with 1.313c. for the previous year.

News of the Week

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Summary

A STRIKE involving several thousand miners, who demand 8 pesos per day, has shut down the mine and smelter of the Boleo Copper Company, operating near Santa Rosalia, Lower California.

During 1924, ten companies in the Coeur d'Alene district in Idaho netted $6,445,000 on an output of $22,552,000.

Suit of the Wolf Mineral Process Co. alleging infringement of sundry flotation patents on the part of Minerals Separation will start in New York.

Assets of the British-America Nickel Corporation in Sudbury, Ont., and Deschenes, Que., have been sold for $5,000,000. Neither the International nor Mond companies can be identified as purchasers.

Production of copper from its Hidden Creek mine will be increased by the Granby Consolidated, in British Columbia.

James W. Neill, American engineer, describes a new project for exploiting iron ore deposits in Japan.

Revolutionary industrial changes may effect seriously the profits of copper and nitrate enterprises in Chile.

Compromise between the Hollinger Gold and Northern Canada Power interests has been effected in Northern Ontario.

The government mint in Vienna, Austria, used 7,000 lb. of silver daily for coinage in 1924.

Foreign capital is needed to develop Argentina's nonferrous metal resources, according to H. Foster Bain.

Coeur d'Alene Mines Netted $6,445,000 on $22,552,000 Output

Bunker Hill, Hercules, Hecla, and Morning Are Leaders—Better Than 1923

In addition to the usual property tax, the laws of Idaho require all mining companies to pay taxes on their net profits at the property rate and on 100 per cent basis. To determine the net profits for the purpose of taxation, all productive mining companies are required to file statements under oath with the county assessor in the county in which they operate, showing the tonnage produced, gross value, costs of production, and net profit or loss. These statements are filed on or before May 1 and cover operations for the preceding year. Practically all of these statements have now been filed for 1924 by the operating companies of the Coeur d'Alene district, from which the following figures, showing gross value of ore produced and net profits, have been compiled:

	Gross Value	Net Profit
Bunker Hill & Sullivan	$6,755,531.95	$2,360,027.74
Hercules Mining Co.	3,567,469.21	1,448,941.42
Hecla Mining Co.	4,220,012.59	1,399,404.97
Federal M. & S. Co.. —Morning	5,703,793.69	1,027,173.74
Federal—Frisco mine	72,551.58	8,126.58
Tamarack & Custer..	1,669,154.62	97,805.50
Stratton Mines Co.	76,292.73	19,555.14
Sunshine Mining Co.	142,526.65	3,342.93
Wood lease, Gem mine	67,957.53	10,011.64
Yukon Gold Co.	160,996.35	71,312.66
Totals	$22,552,315.68	$6,445,701.98

Total deductions on account of operating costs: Extraction, $8,073,811.60; freight and treatment, $6,799,568.03; betterments and repairs, $1,200,798.35. The reports show a small increase in both value of production and profits over these respective items for 1923. In that year the gross value of ore produced was $21,557,681.21, and net profits were $5,165,268.05.

Miners at Boleo Copper Strike for 8 Pesos

FOUR THOUSAND Mexican miners employed at the Boleo Copper Co., operating in Santa Rosalia, in Lower California, went on strike on April 30, according to advices received from that camp. The strikers are demanding an increase in pay from 5 to 8 pesos per day; better company houses; new drainage; water; and a lighting system. It is said that the manager has gone to Mexico City to confer with President Calles and the French Ambassador. Troops have been sent to Santa Rosalia.

Peñoles Takes Veta Grande Lease

The Cia. Minera de Peñoles has taken over the lease formerly held by E. M. Villereal and associates on the lead-zinc properties at Veta Grande, Zacatecas. These deposits parallel the old Veta Grande silver vein. The company is now carrying on development work. There is a small flotation mill now on the property, which will be enlarged into a modern milling plant if the ore reserves come up to expectations.

Michigan Copper "Rock" Gives Highest Yield on Record

Champion Mine Leads with 43.88 Lb. per Ton—Selection Important Factor in Mining

The Champion mine of the Copper Range Company, a half interest in which is owned by the St. Mary's Mineral Land Co., is obtaining the highest yield per ton of rock stamped of any amygdaloid mine in the Michigan copper district, and probably even exceeds the average yield now obtained from the Calumet & Hecla Consolidated's conglomerate vein. The yield from Champion rock last year, 43.88 lb. of refined copper per ton of rock treated, was the richest in the history of this property. It compares with yield obtained by other amygdaloid mines in the district as follows: Ahmeek, 33 lb.; Mohawk, 24; Isle Royale, 25; Quincy, 24; North Kearsarge, 22; Baltic, 31; and Trimountain, 34. Baltic and Trimountain are Copper Range units. Champion's previous high yield was 42.41 in 1920.

For the Michigan district generally, the yield per ton of rock stamped is the highest ever recorded. Were it to average several pounds less, as in the years of comparatively low wages and low cost of materials and equipment entering into mining, fewer mines would be in operation today. Only the richest rock is being mined, to enable the companies to operate, with the least possible loss, until the metal market strengthens. In the meantime effort is directed, also, to the improvement of extraction and the reduction of operating costs to the minimum.

Good Season Expected in American Fork District

American Leasing Co. Will Enlarge Mill—Zinc Ores Can Be Shipped —New Lease

The season is well under way in the American Fork mining district in Utah. At the Pacific, ten men have been working all winter. Other properties, however, were forced to suspend work for several months. An early spring has made possible a general resumption of activity in the principal mines.

Both production and development in the Mary Ellen section of the district will be materially aided by a new road completed last year and by the removal of the ban placed on zinc ores by smelting companies. Completion of the new road adds two months to the season and reduces haulage costs by eliminating all transfer of ores.

The policy of paying for zinc in zinc ores rather than levying a penalty for this metal will enable the American Leasing Co. to market 90,000 tons of ore which C. B. Ferlin, manager, says has been blocked out. The mill capacity of the American Leasing Co. will be tripled to handle the increased output. The expense of doing this will be small, as the ores are treated by water concentration.

Conditions indicate that in the Live Yankee group, the rich copper-gold orebody exploited profitably in the adjoining Silver Wave will be opened. Signing of a long-term lease with the Belorophan Mining Co. gives the American Leasing Co. control of the Belorophan, the Silver Wave, and Live Yanke groups. It is from the latter that A. H. Holden, founder of the United States Smelting, Refining & Mining Co., is said to have mined several hundred thousand dollars worth of ore in the form of galena boulders right from the surface several decades ago.

Oppose Restriction of Immigration from Canada and Mexico

Chambers of Commerce in the Michigan copper district have gone on record against the proposal to restrict immigration from Canada, Mexico, and the countries of South America. The present law does not apply to these countries. Extension of the law to include them, it is held, would further inconvenience the mines of this country in procuring desirable labor. Restricted immigration from European countries has affected both the copper and iron mines, which depend largely on immigration for unskilled underground workers. Cutting off much of the original source of this labor has created a scarcity which the mines find difficult to overcome, the average American laborer preferring surface occupations.

Representatives of states bordering on Mexico will meet in El Paso, Tex., on June 6 to outline a concerted campaign against further extension of restricted immigration. Opponents of the proposed law contend that it would be greatly to the disadvantage of the commercial relationships between Mexico and the United States.

Cynide Gold Ships Concentrate

A part payment of $1,500 was received recently by the Cynide Gold Mining Co. operating at Bonners Ferry, Idaho, from a recent shipment of concentrate to the Bunker Hill smelter, at Kellogg. A full return is expected soon. Following the test run of thirty days made early this year the mill was closed for further underground development, which will insure a steady supply of ore. This work will take from sixty to ninety days more, and the mill will then be started again.

Courts and Patent Office Keep Cool on Flotation Matters

AFTER several postponements, hearing in the suit brought by the Wolf Mineral Process Co., whose New York office is at 165 Broadway, against the Minerals Separation North American Corporation, is scheduled to begin before the United States District Court, in Baltimore, on May 18. The allegation made by Wolf is that the Minerals Separation patents are an infringement of Patent No. 787,814, of April 18, 1905. The arguments pro and con were given in the *Mining Journal-Press* of July 22, 1922, page 161.

No decision has yet been reached in the case of Minerals Separation against the Magma Copper Co., over patents Nos. 835,120 and 962,678, which was summarized by T. A. Rickard in *Mining Journal-Press* of Oct. 20, 1923. The evidence in this important case was all in about two years ago, but evidently the court is not inclined to give snap judgment. Decision seems as far away as ever.

A third bit of disagreement of interest to flotation operators covers the patent rights on xanthate. Both the Metals Recovery Co., in which J. M. Callow is interested, and Minerals Separation applied for patents on the use of this valuable reagent in flotation. Neither has yet been granted a patent, but it is expected that the Patent Office will reach a decision next month.

Belmont Copper Co. Gets Claims at Superior, Ariz.

The Belmont Copper Mining Co. has acquired forty-three mining claims in the Pioneer mining district near Superior, Ariz., and holds in addition thirty-one claims under an option to purchase, on which part payment has been made and under which a final payment of $139,000 becomes due on Dec. 20, 1926.

About 12,000 ft. of development work has been done on the properties, upon which the Calumet & Arizona Mining Co. and the North Butte Mining Co. spent over $450,000 in prospecting before they were acquired by the present company. A steel headframe and additional equipment has been installed and the present shaft, 700 ft. deep, is being sunk to the 1,200 level. Chester Hoastson, is superintendent.

Lucky Jim Buys Rosebery Mill; Will Operate in June

Pays $35,000—Good Milling Ore Developed—Lead, Zinc, and Silver in Orebodies

Shareholders of the Lucky Jim Lead & Zinc Co., of British Columbia, have received a notice from J. V. Pohlman, secretary of the company, stating that the Rosebery mill has been purchased from the Rosebery-Surprise Mining Co., for $35,000, payable over a term of three years, and that milling operations will be started in June. In the meantime, a large tonnage of high-grade milling ore is being broken in the mine. With regard to the development of the mine, the circular says:

"The first work undertaken was the continuance of the crosscut on No. 3 level, to intersect a series of ore-bearing fissures hitherto undeveloped, lying farther in the hill and at a considerably greater depth. Among these was one designated the Big Fracture. This fissure had been exposed in a shallow shaft, sunk from the surface, and gave unusual promise of yielding a large body of ore at depth. After reaching this fracture on No. 3 level, an upraise was started, and this recently encountered a body of ore that measures 10 ft. in width and carries approximately 20 per cent lead, 20 oz. silver, and 10 per cent zinc. The depth at this point is 450 ft. from the surface.

"On No. 5 level development has proceeded upward on the footwall side of the vein, to prove the downward continuation of the orebodies on No. 4 level. This work has met with satisfactory results. There is now exposed a large body of lead-zinc ore in two separate raises from this level, a general sample from one of which gave 20 per cent zinc and 20 oz. silver. In addition to the foregoing, another crosscut from a stope known as 502 recently encountered 4 ft. of 45 per cent zinc ore, in a fissure previously undeveloped above No. 5 level."

Neither Mond nor International Nickel Bought British America?

The auction sale of the properties of the British America Nickel Corporation on May 7 at Toronto resulted in their being sold for $5,000,000 to the legal firm of Saunders, Kingsmill & Company, acting for an unnamed client. The amount is the same as that bid at the former auction, which was not accepted because it was below the reserve price. Negotiations to effect a private sale for a higher figure having been unsuccessful it was not considered advisable to extend the time for effecting a sale. Considerable interest attaches to the identity of the buyer. Officials of the International Nickel Co. and the Mond Nickel Co. at Copper Cliff and Coniston respectively say that they have no knowledge of either of these companies being interested in the purchase.

The sale includes the mines and smelter at Sudbury, together with a power contract, as well as the refinery at Deschenes, Quebec, which also carries with it an advantageous power contract.

"Boy-Police" force of the American Bauxite Co., at Bauxite, Arkansas

The American Bauxite Co. mines most of the aluminum ore used in the United States at Bauxite, Ark., a "company" town. Before the "police" force was started the boys of the community were guilty of a great deal of petty vandalism, thereby contributing largely to the troubles of the town authorities. The company superintendent finally called twenty of the leaders of boy life into his office and gave them a job. They were to constitute the police force of the town. Their duties consist in reporting all suspicious characters; all property that needs repairing; boys or men who commit acts of vandalism; stagnant pools where mosquitoes would breed, and other routine details. For their services they are paid 50c. a week and their positions entitle them to free passes at the motion-picture show. As the boys grow older they are taken into good positions with the company, as their training in being watchful makes them just so much more valuable to the organization. The boys make no arrests themselves, but are expected to report all cases which might require arrest to the chief of the town's regular police force.

Granby Expected to Increase Copper Production at Once

Charles Bocking, recently appointed general manager for the Granby Consolidated Mining, Smelting & Power Co., says that the company is encouraged to resume operations at Copper Mountain, B. C., and that the re-conditioning of the branch line from Princeton, on the Kettle Valley Ry., to the mine is now under way. He expects to begin to ship concentrate to the Trail smelter in July or August. When this mine is in full operation it is expected to augment the Granby company's output by 20,000,000 lb. of copper per year.

The output of the Hidden Creek mine is being increased. During the first week in April, 14,327 tons of ore was shipped from the mine to the smelter and 6,695 tons was shipped to the concentrator. The smelter and concentrator together are treating approximately 3,000 tons of ore per day.

West End Chemical Co. Sued for Interest in Claims

A suit against the West End Chemical Co., which owns and operates borax deposits in southern Nevada near Las Vegas, has been brought by J. M. Keith and R. H. Shaeffer, who claim to be the original locators of the property. The plaintiffs allege that they were defrauded of their share in the price paid for the claims by the co-locators, F. M. Lovell and G. D. Hartman, and contend that they are entitled to an equal interest in certain lode claims located by Lovell and Hartman. The suit is being tried in the United States District Court in San Francisco.

Michigan Copper Production Increases

Stocks Showed Decrease with Opening of Lake Shipping Season— C. & H. Had 45,267,965 Lb. on March 31

Refined-copper production in the Michigan district in April is estimated at 12,350,000 lb. Calumet & Hecla Consolidated and its subsidiary, Isle Royale, are credited with 8,050,000 lb., made up of 2,800,000 from Ahmeek, 1,600,000 from the Calumet & Hecla reclamation plant, 2,500,000 from the conglomerate and Osceola lodes, 400,000 from North Kearsarge, and 750,000 from Isle Royale. Copper Range produced 1,850,000; Quincy, 1,000,000; and Mohawk, 1,450,000.

Calumet & Hecla Consolidated had copper on hand to the value of $6,111,175.28 on March 31, according to the company's earnings statement for the January-March quarter. Reduced to pounds, at the March 31 price of 13.50c., delivered, this gives 45,267,965, compared with 39,375,226 lb. on hand Dec. 31, an increase of 5,892,739 lb. for the quarter. The statement shows a loss of $71,260.87, after charging off $977,636.61 for mine depletion and depreciation of plant and equipment.

The first copper-carrying steamer of the season arrived in the Michigan district April 26 to take copper at the Quincy and Calumet & Hecla smelters. Now that Lake navigation is open, metal shipments will largely increase. Deliveries by rail have been small during the last few weeks, the smelters awaiting the opening of navigation to take advantage of the lower freight rates.

Superior & Boston Ships Carload Daily From Globe

The Superior & Boston Company, at Globe, Ariz., is producing a carload of ore daily from the east extension of the Dewey vein on the 800 level. Exploitation of this vein, which has been one of the company's chief sources of silver ore, was interrupted for a time last fall, when a portion of the vein was lost through encountering a fault. The orebody on the east side of the fault was not located until December, but since then it has been yielding ore of as good grade as that mined west of the fault. The vein varies in width from 2½ to 4 ft. and assays 3½ to 4 per cent copper and 15 to 20 oz. silver per ton.

Deepening of the McGraw shaft, which was started early in the year, has progressed 100 ft. The present contract calls for a depth of 1,700 ft., at which point, if the shaft is in schist, crosscutting will be started. If the formation is diabase, sinking will be continued to a depth of 1,900 ft.

Rich Find in Old Hecla District in Montana

Elward H. Williams is opening a vein of silver-copper ore, from which he has obtained excellent assays, in the Hecla mining district, in Beaverhead County, Mont. His claim is situated about one mile from the old Cleopatra mine, which has a record of producing $20,000,000 in the 80's. The vein is about 12 ft. thick and has been followed on the dip for about 45 ft., with an inclined shaft. Besides silver and copper, specimens show lead and gold.

Keystone Mining Co. Increases Ore Reserves

Park City Producer Plans Installation of Flotation Equipment—Assets Ample

Increase of the ore reserves in the Keystone Mining Co.'s property at Park City, Utah, by exposure, on the 500 or lowest level, of the orebody so productive in the upper levels has been accomplished by two raises, put up on the orebody to the 400 level. These show that the bedded deposit is 25 ft. thick at the points where developed 40 ft. apart on the strike of the shoot.

Also, a drift following the footwall side of the shoot for a distance of over 50 ft. has had a full face of ore all the way. Taking into account the raising and drifting done, the ore has been opened up for a lateral distance of 125 ft. The ore is said to be an excellent mill product similar to that exploited so profitably in the upper levels.

The company is considering the addition of an oil flotation department to its mill. The expenditure of $30,000, it is said, will not only double the capacity of the plant, which is now handling about 125 tons of ore daily, but it will greatly improve recoveries.

On Jan. 1 last, the company had net quick assets of $330,000. During the last three months this amount has been increased by approximately $100,000.

Bauxite Deposit Reported in Chihuahua, Mexico

J. M. Garza Aldape, engineer, of Torreon, Mexico, is certain that he has discovered a large deposit of bauxite in the Santa Rosalia Mountains, near Camargo, in the State of Chihuahua. The foothills between these mountains and the Conchos River apparently are capped with this mineral, covering a large surface area. Analysis of the ores give 59 per cent aluminum and 22 per cent water. The engineer says it would be impossible to estimate the full extent of the mineral deposit, but asserts that there are several million tons in sight. Mr. Aldape has filed on two groups of claims covering a surface area of approximately seventy-five acres, the principal group being recorded as the bauxite mine. A number of Americans are interested and have leased portions of the land from the owners.

The region is only about one mile from the railroad and within two kilometers of the power line from the Boquillos Electric Power Co., from which an abundance of electric power is available.

With the present high freight rates this product cannot be profitably exported.

Bond Claims in Mariposa County

A group of fifteen claims in the Kinsley district of Mariposa County, Calif., north of the Mountain King, which was shut down several years ago, has been bonded, according to local reports, to J. D. Knapp, of Los Angeles. The claims are owned by D. C. Day, B. B. Buck, and others. The option requires work to begin at once.

Iron Mining Enterprise in Japan Seems Assured

James W. Neill Describes Project—Several Hundred Million Tons Available—Ore Must Be Concentrated

By George J. Young
Associate Editor

PLANS for the exploitation of iron ore by the Matsukata interests in Japan are making excellent headway, according to James W. Neill, mining engineer of Pasadena, Calif., who has just returned to Japan to continue his work as consulting engineer for the enterprise.

The iron-ore deposits are on the north end of the main island of Japan, Honshu, the headquarters of the company being at Kuji, where there is an excellent harbor and two rivers supply water for the rice fields. At this point a small blast-furnace plant, with coking ovens and other accessories, has been erected as a pilot unit for experimental purposes and for determining the details of the metallurgical process necessary for the reduction of the ores.

The iron-ore deposits are six or seven miles from Kuji, in the hills, at an elevation of 800 ft., and are marked by an ancient beach line. The ore beds are in the formations overlying Tertiary sedimentaries which rest on schists, quartzites, and limestones. The formation can be traced for about 30 miles along the foothills back of Kuji, and it is believed that the orebody is a persistent feature. Where erosion exposed the orebody, iron ore was mined by Japanese long ago, and the iron was used for the making of sword steel, from which the celebrated Samurai swords were fabricated. Piles of slag remain near open cuts of many acres in extent.

As the wood for charcoal became scarce the smelting operations dwindled and finally ceased. Large trees are now growing in the pits and on the slag piles.

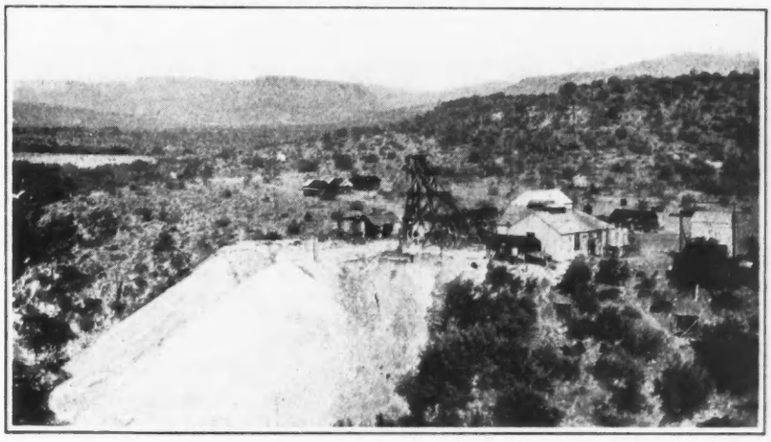
The ores carry a considerable percentage of titanium, and as a consequence exploitation was not attempted until Matsukata, who holds concessions on most of the important areas, demonstrated that the ore could be cleaned and the objectionable impurities removed.

Neill was engaged first to determine the extent and thickness of the deposit as well as the grade of the ores. During 1924, he took a churn drill and outfit, including a Wilfley table, from the United States and drilled 1,597 ft. of churn drill holes and sank 2,225 ft. of shafts over an area 17 miles long and several miles wide. The presence of the ore bed was proved wherever the ancient beach line was found. The available tonnage is large, but no estimate will be made until the further shaft sinking has been accomplished. There is, however, probably several hundred million tons.

The overburden averages about 17 ft. in thickness. It is expected that stripping and open-pit mining with steam shovels will be the method of mining. The ore will be crushed and concentrated on tables and the resulting product subjected to magnetic separation. The final product will be agglomerated and smelted in blast furnaces.

Japan has no large iron deposits now being mined and is forced to import either raw ores or pig iron. As a consequence the exploitation of the Kuji area is looked upon with great interest.

Neill says that he found the Japanese quick to learn and contented workers. He was extended courteous treatment. He also said: "I saw many openings for American products as well as for American enterprise. Agriculture, strange to say, appears to offer the most opportunities. In the region which I inspected there is a large area suitable for wheat growing which is now only producing bermuda grass. Tokio and Yokohama are rapidly rebuilding, the new construction being of wood covered with sheet iron, but many substantial buildings are also being erected and many civic improvements are being made."



Surface plant at the Kay Copper mine in Arizona

At this property, situated on the Agua Fria River, 40 miles from Phoenix, development work is proceeding regularly with diamond drilling from a 1,100-ft. drift on the 1,200 level. About $35,000 is being spent monthly, and a good tonnage of 4 per cent ore is indicated.

News from Washington

By PAUL WOOTON
Special Correspondent

Foreign Capital Needed to Develop Argentina's Non-Ferrous Metal Resources

Government Collecting Data on Mineral Deposits—National Lead Co. Has Developed Some Mines—Public Little Interested

ARGENTINA will have to depend largely on foreign capital to develop its non-ferrous metal resources, in the opinion of H. Foster Bain, the Director of the Bureau of Mines, who has just returned from that country, where he was called by the Argentine Government to examine the possibilities of iron and steel making. His report has just been turned over to the Argentine Ambassador in Washington. It will not be made public here.

Agriculture has so predominated the activities and the thought of the Argentine people, Mr. Bain says, that little interest has been taken in mining. As a result there has been little development of the country's mineral resources. Government geologists brought in the first oil well in the country. Subsequent development has been done largely by foreign companies.

Metal mining has been confined largely to lead. The National Lead Co. has been responsible for most of the development of that metal that has taken place. Thus far it has been found nearly impossible to induce Argentine capital to undertake mining enterprises. Those with money have such a predilection for agricultural ventures that they could not be interested in undertaking mineral development.

Dr. Thomas A. Le Breton, who formerly was Ambassador to the United States, is at the head of the Department of Agriculture, which includes the "Direccion de Mines." He is much interested in the republic's mineral resources and is gathering data as to their value and extent. General A. P. Justa, the Minister of War, likewise is greatly interested. While most of Argentina is much the same type of country as our Mississippi Valley, in the west and north it reaches into the Andean and Pre-Cordilleran areas, where mineralized zones exist. The principal mineralized area is physically and geologically an extension of Bolivia. The lead operations there are capable of considerable expansion, Dr. Bain says. At present production is limited to the domestic demand, which means that the metal is sold at a price nearly equal to the world price plus freight. If the industry is extended so as to enter the export trade, it will have to produce at world price less freight. Before this can be done extensive new facilities will have to be provided. Bolivia is an exporter of lead, but there the silver content is much higher than is the case with the deposits thus far opened up on the Argentine side of the boundary.

The abundant occurrence of lead in this region long has been known. Its production will result also in an output of silver, as the two metals occur in the same areas. Antimony, tin, wolframite, and other metals occur, but information concerning those deposits is fragmentary.

The two provinces of Jujuy and Salta, containing the bulk of the country's non-ferrous minerals, are intersected by the railroad between Buenos Aires and La Paz. Though the region will have a rail outlet, the haul will be long and difficult. The mining districts lie at an elevation 14,000 ft. above sea level. Despite the elevation, sufficient labor will be avaliable for the conduct of mining operations.

With the possible exception of lead production, there is no expectation that more than a very gradual development can be brought about. The hope of the administration is that a much larger proportion of the country's needs can be supplied from domestic sources, and that thereby it will be possible to build up a more favorable trade balance. The country had a favorable balance of trade in 1924 for the first year since the war.

Though very rich copper ore is known to exist in the Andes in the province of Mendoza, its distance from transportation facilities probably means that no early exploitation of that resource can be undertaken.

Early use of native clays for refractories will be undertaken in the relatively near future, it is expected. Building brick already is produced widely and constitutes the principal building material.

Bureau of Mines a "Maverick," It Would Seem

An opinion of the Attorney General is to be sought, it is understood, as to the legality of the proposed transfer of the U. S. Bureau of Mines to the Department of Commerce. The two secretaries concerned favor the transfer. The President has given his consent if such a transfer can be made legally. There is great doubt as to the legality of the transfer of a bureau created after the enactment of the act which gave the President power to transfer certain bureaus to the Department of Commerce.

North Star Sinks

Deepening of the principal working shaft at the North Star mine, at Grass Valley, Calif., is now under way. The new section of shaft was started some distance below the old shaft, access being afforded by an incline. Milling operations have been started at the Brunswick mine, and development of the new vein recently cut on the 1,100 level is in progress.

Vienna Mint Uses Much Silver

The output of the Vienna, Austria, mint last year was the greatest since its foundation, according to the U. S. Department of Commerce. Of the coins struck, only a small fraction was for Austrian account, the great bulk going to Poland, Bulgaria, and to North and East Africa. Altogether, the mint turned out 341,000,000 coins. The daily consumption of silver averaged about 7,000 lb. Orders so far received for 1925 delivery total 538,742,000 coins, of which 280,000,000 will be for the account of foreign countries.

Political Revolution in Chile May Affect Copper and Nitrate

Unionization of Industrial Workers Compulsory—Pension Funds and Profit Sharing Demanded

Revolutionary industrial changes are accompanying the political convulsions in Chile. These changes are certain to have far-reaching effects, which will be felt in the United States. Nitrate of soda and copper are the two Chilean products in which the United States has greatest interest.

A new code of labor legislation was put into effect on March 26 by executive degree. In addition to providing overnight for radical changes, the new code is said to have been formulated in haste and promulgated without hearings or consultation with employers.

The new legislation will add no less than a shilling to the cost of each quintal of nitrate, it is declared. It provides, among other things, that all plants must be unionized. Employers are precluded from dealing with their workers except through the organization. Each employer must pay into a pension fund an amount equal to 2½ per cent of the payroll. The employees also must contribute 2½ per cent of their wages to the same fund.

Provision is made for profit sharing also. In general terms 20 per cent of the profits of industry, after some allowances for depletion and other items have been made, must be shared with the workers up to an amount equal to three months' wages for each employee.

It is declared by some in Chile that the program has its inspiration in Moscow. Despite all of the difficulties of the situation, the Chileans have an inborn stability which gives promise of pulling them through this crisis without resort to civil war, which might result in paralyzing business.

Silver Producers to Have Hearing on Revaluation

In connection with the revaluation of silver-mining properties for federal taxation, it is reported that the Internal Revenue Bureau will soon invite silver producers to file final protests, briefs, and other data respecting revaluation, so that all cases may be completed prior to a joint hearing to be granted silver producers at a date to be announced later. This presumably will be about June 15. It is said that the bureau will not consider its present plan to revalue silver properties final until after this hearing.

Spanish Lead Mining Suffers for Lack of Capital

Increased Bullion Output for 1924—Concentrates Come From Foreign Countries—Finished Product Exported

Production of lead in Spain during 1924 totaled 137,114 metric tons, compared with 127,514 in 1923, according to our commercial attaché at Madrid. Mines in the Province of Jaen produce almost half of the total Spanish production. Next are those in Cordoba, and third those in Murcia, which some years ago held the highest rank. Murcia counts among its producing mines those of Cartagena, La Union, and Mazarron. The 1924 figures in the accompanying table cover only two provinces, in addition to the three principal ones, and cannot be considered complete. The total production of concentrate during 1924 for Jaen was 87,570 metric tons; for Cordoba, 46,035; and for Murcia, 23,168.

Spanish Production of Refined Lead

Province	1923	1924
Jaen	33,996	38,416
Cordoba	37,506	43,593
Murcia	35,789	42,195
Others	20,224	12,910
Totals	127,514	137,114

La Sociedad Minera y Metalurgica de Penarroya, the French company, is the principal producer of lead, and has large lead, zinc and silver smelters in Cordoba. The same company has important mines also in Jaen, but the principal mining company of that province is the Sociedad Minera y Metalurgica los Quindos, owned by German and Spanish interests, which produces at present an average of 20,000 tons of galena per year. This same company has constructed in Malaga a modern plant with a capacity of approximately 28,000 tons annually of lead, which may be readily enlarged to accommodate 50,000 tons.

The other lead mines in Spain are in the hands of Spanish mine owners, but are for the most part poorly financed and are operating on a hand-to-mouth basis. They are not developed extensively and are little more than surface worked.

The diminishing production in the lead mines of the Province of Cordoba has been ascribed to the fact that the mines have become flooded, and no adequate means has yet been found to drain them properly. The mines have not been developed to their full extent, on account of lack of capital, but the present prices for lead are having a stimulating influence.

The principal lead mine of Murcia is owned by the Sociedad Minera y Metalurgica de Mazarron, financed largely by Germans. The company is equipped to produce as much as 36,000 tons of lead annually, but at present the output amounts to only 17,000 tons. The company imports lead ores and concentrate from points as distant as Australia. In Murcia there is another plant of about 10,000 tons' annual capacity, which belongs to the Mancomunidad Zapata, financed by Spanish capital.

In the Province of Jaen there are two important smelters, one operated largely by English capital and the other by French capital; their capacity is about 20,000 tons a year for each. Quotations for lead in Spain depend largely upon the London market, and the price is fixed locally by a commission, which is partly influenced by London quotations regulating the price under government supervision. Only about 20 per cent of the production is consumed by Spanish industry.

There is a considerable variation in the quality of Spanish lead ores. In Jaen, the first-class ore carries 80 per cent lead and 0.45 per cent of silver. The Cordoba average is 60 per cent lead and 0.1 per cent silver, and the Murcia average is 52 per cent lead and 0.2 per cent silver.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Hollinger Compromises Long Dispute With Power Company

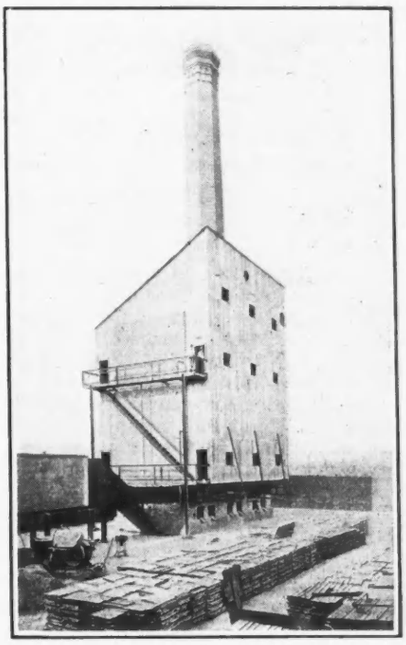
Gets $500,000 and New Contract for Power—Consolidated Goldfields Out of Porcupine Company

Toronto, May 9—The long-drawn-out power litigation between the Northern Canada Power Co. and the Hollinger Consolidated Gold Mines of Porcupine has finally been settled. Though the details of the settlement have not been announced, it is understood that the power company pays the Hollinger $500,000 and all existing suits are withdrawn. The lawyers of the opposing sides had already made arrangements to sail for England, where the case was to come up before the Privy Council, but their reservations were canceled at the last moment. The settlement also takes in the Hollinger power plant, which is to be acquired by the Abitibi Pulp & Paper Co. at a price understood to be $5,500,000.

The Hollinger company also gets a new contract for power under which, it is understood, the price for the first 10,000 hp. will be at the rate of $50 per horsepower-year; and for any amount above 10,000 the rate will be considerably lower. This appears to be a very satisfactory settlement, and under it the loss to the Hollinger will be comparatively small.

A situation which has held back the development of the country is now settled, and the power company will be in a position to make arrangements for the disposal of its surplus power, a considerable part of which will probably go to the Noranda Mines, in the Rouyn district of Quebec.

The Great Northern Power Co., which also has a line into Porcupine, has notified the bondholders that the interest due May 1 will be passed owing to the poor earnings of the company. The only mines taking power from this company are the Coniarum, in Porcupine, and the Night Hawk Peninsular. The company has $850,000 of 7 per cent bonds outstanding, and the gross revenue from the sale of power is less than the bond interest, without making allowance for operating expenses. It is possible that arrangements may now be made to bring this power line into Gowganda, where power is badly needed.



Cottrell plant at Monterey

Fumes from the silver capels in the refinery at the smelter of the Peñoles company are recovered in this treater of the pipe type. Cyanide bullion, precipitates from various mills, and dross from the lead smelter are cupelled.

The directors of the Vipond company have decided to proceed immediately with the sinking of the main shaft from 1,000 to 1,300 ft. Recent diamond-drill results below the 1,000 level have been very encouraging, and the deepening of the shaft and the development of this lower area are considered essential before proceeding with the enlargement of the mill.

The new shaft of the McIntyre is now down about 600 ft., and progress is being made at the rate of approximately 200 ft. a month.

Some surprise has been caused by the withdrawal of representatives of the new Consolidated Goldfields, Ltd., and the National Mining Corporation from the board of the Porcupine Goldfields Development Co. This latter company, which has been financed by English interests, owns the Ankerite property, in Porcupine, and has an option on the Young-Davidson property, in Matachewan, as well as the Stemwinder property, which adjoins the Sullivan lead-zinc mine in British Columbia. Operations on the Young-Davidson have not been encouraging, but it is understood that on the Ankerite property approximately 200,000 tons of profitable ore has been developed. It is reported that the dispute between the directors which led to these resignations is not with relation to conditions at the different properties which the company is operating.

Production from the Teck-Hughes mine showed a substantial increase during April, amounting to close to $90,000, the highest record for any month this year. A feature was that the ore yielded approximately $21 per ton.

London Letter

By W. A. Doman
Special Correspondent

Mines de Villemagne Has 1,000,000 Tons of Blocked Ore

Prospects Are Good — Zinc-Lead Concentrator Under Construction— £2 Per Ton Profit Expected

London, April 28—A circular issued by the Russo-Asiatic Consolidated gives an exhaustive summary of the diamond drilling and development work carried out on the property of the Compagnie Nouvelle des Mines de Villemagne, in France, in which the company is largely interested. The result of this work is that ore reserves of about 1,000,000 tons are indicated above the depth of 80 m. in the eastern and central sections and 60 m. in the old, or western, section. The vein has been cut by boreholes 170 m. deeper, and as the geological features are the same, the possibility exists of developing several million tons of ore down to the deepest point tested.

Preliminary work on ore treatment has been completed and the first mill unit of 45,000 tons' annual capacity is in course of erection for the production of lead and zinc concentrates. This unit will be completed by the end of 1925, when further units may be undertaken.

Water-power is available for a good part of the year, and an auxiliary steam plant will be installed for use during the dry season. An aërial cableway is in course of erection and should be in operation on the completion of the mill. It has been designed for a capacity to handle the products from 150,000 tons of ore per annum. The program provides for the treatment of 45,000 tons in 1926, 90,000 in 1927, and 135,000 in 1928-30.

It is estimated that the financial resources of the Compagnie Nouvelle des Mines de Villemagne are ample to place the business on a profit earning basis. With prices of £36 per ton for lead and zinc, the average grade of ore will return a profit of £2 per ton under the program outlined. The size of the mineral deposits would, however, justify a system of selection that while assuring a long life for the enterprise would yield a higher profit per ton.

The Soviet authorities show no sign of returning the mining properties to the Russo-Asiatic Consolidated. They are endeavoring to attract private capital by permitting companies consisting of twenty or fifty members to be formed, but as there is no security, English financiers are holding aloof, and meantime the immense mineral resources of the country remain undeveloped.

The Rhodesian Congo Border Concession has received a cable dispatch giving the results of the No. 4 borehole at Munshiwemba in the eastern, or porphyry, area of the concession. The hole is located 800 ft. southwest of borehole No. 1, on the same strike, and is sunk at an angle of 45 deg. Samples assay thus: from 25 ft. to 90 ft., 2.1 per cent copper, of which the section between 45 ft. and 75 ft. assays 4 per cent copper, and between 50 ft. and 70 ft., 4.8 per cent copper. The copper is a sulphide.

I recently mentioned that Trewartha-James had proceeded on a mission to Southwest Africa. Although no official announcement has been made, I understand he has gone to Walfish Bay to investigate a tin occurrence discovered by the Germans before they were compelled to abandon the country. Unlike the Nigerian deposits, it is a lode, and is said to be very extensive. Samples of it shown in London are of high metallic content.

Melbourne Letter

By Peter G. Tait
Special Correspondent

Richard Hamilton Describes Benefits of Gold Mining

How State Would Profit by Gold Bounty — Suction-Cutter Tin Dredge Not Yet Success

Melbourne, April 7—Speaking at the annual meeting of the Western Australian Chamber of Mines held on March 31, the president, Richard Hamilton, general manager of the Great Boulder Proprietory Co., Kalgoorlie, said: "Of all the many suggestions put forward for the relief and revival of the gold-mining industry, your council considers that the proposal for the payment by the Federal Government of a bonus of 20s. on every ounce of gold produced during the next ten years is best calculated to restore the prosperity of the industry throughout Australia, and to ensure its speedy expansion. . . . As regards the industry itself—and here I speak more particularly of this state—it would be equivalent to a reduction of working costs that would make profitable the treatment of 6 dwt. to 8 dwt. grade ore, of which millions of tons are already known to exist throughout our vast auriferous areas. That alone would induce numbers of prospectors to go out and look for new fields; it would encourage companies to tackle low-grade propositions in a big way; it would enable the mines now working to treat quantities of low-grade ore which they are at present compelled to leave *in situ;* it would lead, both here and elsewhere, to a great development in mining. That would very soon react to the advantage of the commonwealth. There is no industry that yields wealth so quickly, and so quickly disseminates it through the community. An increased output of gold would attract population from outside just as surely as the money spent on immigration, and it would draw people from the over-populated capitals to growing gold-field centers. In this state it would bring about the effective occupation of many parts that are not suitable for farming. In the matter of public works and services, commonwealth and state would benefit. In centers already settled it would prevent the huge depreciation of these public utilities which is inevitable unless the decline of mining is checked; and in new centers the increase in population would require such services to the profit of the state, and settlers in these centers would soon be numerous, for no primary industry employs so many men in proportion to its production as gold mining. That fact makes the industry of greater proportionate immediate value to this community than any other.

"The whole of the wealth won by gold mining is produced within the commonwealth; all but a small portion of it is distributed among the people of the commonwealth; nearly the whole cost of winning that wealth is paid to the people of the commonwealth, to whom also the whole of bonus paid by the commonwealth eventually returns, and, finally, there is no industry which so quickly attracts capital and in which money is more eagerly and lavishly invested. The more flourishing the industry, the more readily is capital poured into it.

"Should the commonwealth government assist the industry by the bonus payment proposed it could find no more profitable investment for the money in the benefit it would thereby confer upon the whole of Australia. No possible harm can be done to other industries, but, on the contrary, they would reap the advantage of fresh markets in Australia for their products. Nor would the commonwealth stand to lose, as in the case of sugar, by over-production, for gold cannot be over-produced."

Bonus for Discovery of New Mines Increased by £250

With a view to encouraging mining development the New South Wales Department of Mines is offering additional inducement for the discovery of new mines. Under the old regulations a bonus of £1,000 was granted, but further inducement is now offered in the form of a bonus of £250 for the discovery of any mine located at least one mile distant from the nearest producing mine, if the production during the first twelve months is valued at £2,000, and a further bonus of £250 may be payable for a similar production in the second year.

The Thompson suction-cutter dredge installed at the Tingha Tin Co., Tingha, New South Wales, has not yet been the success anticipated, but F. G. Wilson, the general manager, states that improvements in the design of the cutter by the attachment of teeth instead of blades promise to give satisfactory results. He points out that the bucket dredge took a considerable time to reach its present standard, and he considers it is only to be expected that the suction-cutter principle would pass through similar developments. A number of these suction-cutter plants are being installed in the Federated Malay States, and, according to the latest reports, the initial difficulties are being overcome. If it is found that the cutter plant can handle sufficient large quantities, the Tingha company should be able to show better financial results.

A dividend of 1s. per share, absorbing £122,750, is to be paid by the Broken Hill Proprietory Co. The last dividend was paid in August, 1921, and up to that date the company was a consistent dividend payer, having distributed over £12,450,000.

Situation at the Mines

By Arthur B. Parsons
Assistant Editor

NOTWITHSTANDING the marked deflation in the prices that metal-mining companies are realizing for their product, operations, generally, are proceeding actively. Output at the mines is high, and though lower metal prices naturally take some of the zest from prospecting, exploration and development are not slackening. Table I shows the gradual decline in the figures on which smelter returns are based. Most lead and silver producers can do very well at current prices; zinc miners are chiefly apprehensive of a still greater decline; but "high-cost" copper producers are not content with 13.25c. for their metal.

Production of copper has been increasing, but early curtailment is likely. The average monthly mine production in the United States for the first quarter of 1925 was approximately 146,000,000, against 136,000,000 lb. in the concluding quarter of 1924. In March the figure was 150,000,000. Table II shows the estimated current rate of output of the larger producers. Several marked reductions from recent rates are to be noted. Anaconda, without saying anything about it publicly, increased its output at Butte in recent months to 23,500,000 lb. or more. Now reports, inspired in New York, then denied by the vice-president in charge of operations at Butte, and finally reaffirmed, place current production at around 20,000,000 lb. Inspiration has curtailed by nearly 2,000,000 lb. from the rate of recent months; and Chile is to reduce from 20,000,000 to 17,500,000 lb. Although Anaconda does not make production data public, and the accuracy of these figures is therefore problematical, material curtailment, no doubt, has been effected.

Miami, United Verde, and Cerro de Pasco, on account of floods in Peru, are at a somewhat lower rate than heretofore. So far, no curtailment by others has been reported. The Jackling properties have no intention of curtailing; indeed, they have consistently pursued a course of outputting at about 80 per cent capacity. On the other hand, New Cornelia, Calumet & Arizona, Calumet & Hecla, and Granby Consolidated are among those who have increased production, or will soon increase. In Africa the Union Minière produced 15,366,000 lb. in April, but the dry season is beginning in the Belgian Congo, and some increase is to be expected, though perhaps not to the high mark of 20,000,000 lb. produced last August.

Table II—Estimated Current Rate of Copper Production

United States	Pounds
Anaconda	20,000,000
Arizona Commercial	700,000
Butte & Superior	1,200,000
Calumet & Arizona	5,000,000
Calumet & Hecla Con.	7,000,000
Copper Range	1,800,000
Ducktown	600,000
Engels	1,200,000
Isle Royale	750,000
Inspiration	6,500,000
Kennecott	4,000,000
Magma	2,300,000
Mammoth	500,000
Miami	4,500,000
Mohawk	1,450,000
Mother Lode	3,000,000
Nevada Con.	6,000,000
New Cornelia	6,500,000
Ohio	1,000,000
Old Dominion-Iron Cap	3,000,000
Phelps-Dodge (U. S.)	13,500,000
Quincy	1,100,000
Ray-Chino	12,000,000
Tennessee	1,250,000
United Verde	8,000,000
United Verde Ex.	3,800,000
Utah Copper	18,500,000
Walker	1,100,000
Total	136,250,000
Foreign	
Braden	15,000,000
Boleo	1,500,000
Cerro de Pasco	2,500,000
Chile	18,000,000
Consolidated M. & S.	200,000
Falcon	450,000
Furukawa-Sumitomo	5,000,000
Granby	3,500,000
Greene-Cananea	2,500,000
Howe Sound	2,200,000
International-Mond Nickel	2,500,000
Katanga	16,000,000
Matahambre	1,800,000
Moctezuma	4,000,000
Mt. Lyell-Mt. Morgan	1,000,000
Totals	76,150,000

Lead mining continues with little change. Figures for March show 70,702 tons of crude lead produced from the principal American and Mexican mines compared with 63,368 in January and 60,864 for the short month of February. This rate probably has been maintained. In South-east Missouri the St. Joseph Lead Co. continues its normal production. The Annapolis Lead Co. was forced to suspend operations as a consequence of the tornado in March and is now in the hands of a receiver, but its production was not large. Utah smelters continues to receive heavy shipments, although some of the small irregular producers have suspended.

Table I—Average Metal Prices

Period	Copper	Lead	Zinc	Silver
January	14.709	10.169	7.738	68.442
February	14.463	9.428	7.480	68.472
March	14.004	8.914	7.319	67.808
April	13.252	8.005	6.985	66.899
May (First week)	13.292	7.758	6.869	67.53

The Coeur d'Alene district in Idaho is thriving with the "regulars" producing at high capacity and development projects, such as the Stratton, Western Union, Galena, and Ajax, in active operation. A fire on the 2,000 level of the Hecla stopped production for a week, but operations again are normal.

In the Joplin zinc district some curtailment from the 17,000 tons of "jack" produced in recent weeks is probable. Stocks of concentrate are accumulating at the mills, and a number of plants have been shut down for a general overhauling. Some have discontinued night-shift operation, and 15,000 tons is probably close to current output. Zinc production in the Western states is near normal. The Sullivan Mining Co. has started shipping 100 tons of ore daily to the Bunker Hill flotation plant. The resulting zinc concentrate will go to Belgium pending the possible erection of an electrolytic plant at Kellogg. The Belgian interests also have negotiated successfully the purchase of the Consolidated M. & S. Co.'s surplus zinc concentrate.

Silver production in Tonopah was curtailed in April on account of temporarily bad conditions in the Tonopah Extension mine, but these have been overcome. A number of small enterprizes in Inyo County, Calif., are producing silver ores. The $2,500,000 option on the California Rand mine has been dropped, but 7,974 tons of $23 ore was milled in April. The Colorado-Ophir, in San Miguel County, Colo., is operating its new fifty-ton flotation plant.

Gold production in Ontario is higher than ever before, the total production for April being $2,500,000. The McIntyre mill is being further enlarged in expectation of treating 200 tons more per day. The new shaft is progressing rapidly. The Vipond mill will be increased to 300 tons. The Lake Shore and Wright-Hargreaves, at Kirkland Lake, both have increased output. The Teck-Hughes mill is being enlarged to 250 tons per day. A brand-new contributor to America's gold production is Gilbert, Nev., from which ten tons of $84 ore has been shipped. Only time will tell what lies ahead at Gilbert. Free-milling gold ore has been found in the White Caps mine, at Manhattan, Nev.

Iron mining in the Lake Superior region has started on a good scale in spite of the 50c. cut in the price of ore over last year's price. It is estimated that shipments will be 52,000,000, against 43,000,000 tons in 1924. Iron-ore production from Utah by the Columbia Steel Co. is to be increased to 500 tons daily.

Reports from Mexico are not entirely reassuring, although production of metals is high. Miners at the Boleo copper property, in Lower California, have struck, it is reported, for a wage increase of from 5 to 8 pesos per day, and sundry improvements in working conditions. The manager has gone to Mexico City to consult with government officials. The Guanajuato Reduction & Mines Co. has posted formal notice to the effect that it will suspend operations on May 18. It is alleged that burdensome laws are responsible for this move. The company is one of the largest operators in Mexico, and employs thousands of men.

Men You Should Know About

John Melhase, geologist, will investigate asbestos deposits near Globe, Ariz., in the near future.

A. V. Eulich, who has been engaged in placer mining in Angola for the last two years, arrived in New York on May 2, from Antwerp.

James L. Ashley, vice-president and treasurer of the International Nickel Co., sailed from New York on May 9 for a short stay abroad.

Percy E. Barbour, who recently visited the Cœur d'Alene mining district, Idaho, in the course of a tour of Western mining states, has returned to New York.

James R. Finlay, mining engineer of New York, was in Wallace, Idaho, on April 28 and inspected the new surface plant of the Hecla Mining Co., at Burke.

Walter Hochschild, formerly connected with the American Metal Co.'s activities in Mexico, has been transferred to the New York office of that company.

Colonel H. H. Stout, of the New York office of the Phelps Dodge Corporation, was operated on last week for a minor ailment but has resumed his office duties.

Glenn T. Allen, mill superintendent of the San Francisco Mines of Mexico, at Parral, Mexico, was recently in San Francisco. He is visiting flotation mills in the Western states.

J. W. Neill, mining engineer of Pasadena, Calif., is en route to Japan, where he will be consulting engineer for the Matsukata interests, who are engaged in exploiting an iron-ore deposit at Kuji.

Wallace W. Boone, formerly assistant professor of metallurgy at the University of Cincinnati, Ohio, is now with the American Radiator Co. at Detroit. He will have charge of the laboratory of the Michigan plant.

Dr. W. J. Uglow, professor of mineralogy and petrography at the University of British Columbia, has been made a fellow of the Royal Society of Canada in consideration for his researches on Canadian geology.

J. Nivette, representative of the Vieille-Montagne Zinc Co., of Belgium, is at Vancouver, B. C., seeking supplies of zinc ores and concentrates. He says that his company is prepared to finance or to operate zinc properties in British Columbia.

P. P. Prandstetten, general field manager for the Vacuum Oil Co., in Europe, was in Houston, Tex., recently after making a tour of inspection of the Oklahoma oil fields. From Houston, Mr. Prandstetten will visit some of the Gulf Coastal fields of Texas and Louisiana.

Frederick G. Clapp is in New Zealand, where he has been conducting examinations since last November. Western Australia was reported to be unfavorable for oil or gas, as were also South Australia and Victoria, and he proceeded to New Zealand, where his clients have large areas under lease.

Daniel C. Jackling, copper magnate, and a party from San Francisco, are touring points of interest in the Southwest while Mr. Jackling makes his regular trip of inspection of the different copper mines in which he is interested. Leaving their private car in Santa Fe, the party made a trip to the ancient Pueblo of Taos by auto, accompanied by **Wesley Bradfield,** of the New Mexico State Museum staff; **Gerald Cassidy,** an artist, and **C. J. Crandall,** superintendent of the Indian Service. On the return trip they visited San Gabriel ranch, at Alcade; San Juan, and other points of interest. Later they witnessed an Indian dance at San

Daniel C. Jackling

Felipe, and Mr. Jackling made a business trip to Gallup, rejoining the party at Belen to make the trip to Hurley and Santa Rita, N. M., and Ray, Ariz. The trip will continue through the Grand Canyon and back to the west coast. The party was greatly interested in the restored pottery, classified artifacts, photographs, and other results of the research work which has been done in the Mimbres area by the Museum under the direction of Mr. Bradfield, which work has been financed by the Chino Copper Co. during the last two seasons.

G. P. Bartholomew, manager of the coal-mining department of the American Smelting & Refining Co., left on Monday for a stay of a month or more at the new Rosita zinc plant at Sabinas, Coahuila, Mexico. **C. L. Baker,** general manager of the Mexican Smelting Department, recently returned from Mexico.

Frederick Burbidge, of Wallace, Idaho, general manager of the Federal Mining & Smelting Co., is in the Joplin-Miami zinc field, where the Federal company owns and operates numerous mines and is engaged in much prospecting for new ones. Mr. Burbidge will visit the main office of the Federal company in New York before returning to Wallace.

W. U. Aghan, metallurgist, of Melbourne, Australia, who accompanied a syndicate to the French island of New Caledonia to report on the mineral resources of that island, returned to Melbourne early in March. He has since again sailed for New Caledonia (which is in the South Pacific about a thousand miles from the Eastern coast of Australia), to make a thorough geological inspection of the Dihot River on that island.

John M. Bush, superintendent, for the Cleveland-Cliffs Iron Co., of the North Lake mines, west of Ishpeming, Mich., has been promoted to be manager of the land department of the company. **Charles J. Stackles,** superintendent of the Republic and Spies mines, at Republic and Iron River, Mich., respectively, has been made superintendent of the North Lake district, and **William R. Myers,** assistant district superintendent of the Mesabi range, takes Mr. Stackles' place at Republic.

Hugh Henry Brown, mining lawyer, formerly of Tonopah, Nev., has opened law offices in the Foxcroft Building in San Francisco. He was a member of the California bar before going to Nevada in the early days of the mining boom. For a number of years he has been counsel for the Tonopah Mining Co. of Nevada, the Tonopah Belmont Development Co., and other interests in the state. **Captain Walter Rowson** continues in charge of Brown and Rowson's office in Tonopah, Nevada.

Edward H. Orser, consulting mining engineer and geologist, of Kirkland Lake and Swastika, Ont., has opened up the Kirkland Central property, in the Kirkland Lake area of northern Quebec, which had been closed for two years. In 1923 he took charge of operations and did a considerable amount of surface work to prove geological conditions and prepare the way for a more elaborate progress. Shaft sinking will be started this month. The statement that E. H. Greer was in charge of the Kirkland Central property, in our issue of May 2, which had been received in our routine news service, was not in accordance with the facts.

M. T. Williams, well known in Australian gold-mining circles as manager of the Edna May mine, in Western Australia, which has paid more than £320,000 in dividends, a short time ago made a visit to Borneo and returned to Australia towards the end of February. Before going to the Edna May, Mr. Williams was manager of gold mines in Bendigo and other parts of Victoria. He is now managing director of the Borneo Oil Options Syndicate, Ltd., which holds an option over extensive concessions in Dutch East Borneo and which is registered in Perth, Western Australia.

Obituary

W. J. Watson, for several years manager of the Tyee smelter, at Ladysmith, British Columbia, died suddenly as he was leaving his home, 3,857 Granville St., Vancouver, for a game of golf, on April 28. He was fifty years old.

Recent Technical Publications

Reviews, Abstracts, and References

Intelligent Tariff Making

Making the Tariff in the United States. By Thomas Walker Page. Pp. 281. Published by the McGraw-Hill Book Co. Price, $2.50.

When all is said and done, making the tariff in the United States is an unsatisfactory procedure, and its defects are lucidly exposed in this book. The group making the loudest noise and using the heaviest pressure to bear on its Congressmen in Washington gets the tariff protection demanded. Politics is an important ingredient of all tariff legislation at Washington, as the author points out early in his text. The oft-heard argument that the "tariff should be taken out of politics" is branded as useless. It simply can't be done. The tariff is bound to be connected closely with political representation under our system of government. Reform, according to Mr. Page, must take the direction of enlightening Congress and the citizenry at large with information showing what the various duties should be and curbing Congress from ill-advised tariff laws. He selects the Tariff Commission as the agency for doing this work, providing it with a high-grade personnel to perform its tasks quickly and impartially and to reduce its tariff information "to intelligible form."

The author is adept in showing the unworkable features of several phases of the present tariff act, particularly the section authorizing the Tariff Commission to obtain the production costs of foreign producers—an activity which recently subjected the government to hostile criticism abroad, much as the author predicted in his book. The flexible tariff provision, through power conferred upon the President, is also characterized as impracticable. Mining men will be interested in reading Mr. Page's conclusion as to a tariff on copper. This, he believes, would have a negligible effect on competition from foreign producers.

One is impressed after reading this book at the impartial way in which Mr. Page has handled his subject. He cannot be accused of being either a free trader or a high protectionist. Both classes of readers will find much to ponder over in the text. Their understanding of the tariff, the forces which move it and which it moves, will be decidedly benefited. F. E. WORMSER.

Gold Coast—A 20-page pamphlet has been prepared by A. E. Kitson entitled "Outline of the Mineral Resources of the Gold Coast, with Hints on Prospecting." It is obtainable from The Director of the Geological Survey of the Gold Coast, British West Africa, 29 Alfred Place, South Kensington, London, S.W. 7, England.

An annual report of the mining department of the Gold Coast for the period April, 1923, to March, 1924, 32 pages, is obtainable for 2s. from the Crown Agents for the Colonies, 4, Millbank, London, S.W. 1, England.

Idaho Petroleum—In pamphlet No. 12, Bureau of Mines and Geology, Moscow, Idaho, 24 pages with maps and charts, Arthur M. Piper discusses "Possibilities of Petroleum in Power and Oneida Counties, Idaho."

South Australia—The annual report of the Director of Mines and Government Geologist for 1923, 7 pages, has recently been received from the Department of Mines, Adelaide, South Australia.

Spanish Statistics—We have received a volume of 632 pages, with numerous charts and tables, entitled "Estadistica Minera de Espana" for the year 1923. Obtainable from Consejo de Mineria, Serrano, 3, Bajo, Madrid.

Electrical Directory — The American Institute of Electrical Engineers, 33 West 39th St., New York City, has issued its 1925 year book containing an alphabetical and geographical directory of its 16,403 members.

Carbon Dioxide Recorders—U. S. Bureau of Mines *Reports of Investigations*, Serial No. 2,668, 3 pages, obtainable on request, discusses the testing of carbon dioxide recorders; by J. F. Barkley.

Indo-China—A report on mining in French Indo-China for 1923 has recently been issued, 12 pages and several plates. Obtainable from Gouvernement Général de L'indochine, Hanoi, Indo-China.

Petroleum—A new Belgian publication on petroleum has appeared, the only one in Belgium dealing with the oil industry. The name of the periodical is "Petromine," and it is to appear on the fifteenth of each month, beginning with January. It is planned to have it cover the technical, political, commercial, and financial phases of the industry. The foreign subscription price is 35 fr. per year, and the address is Petromine, 5 rue de la Fraternité, Bruxelles, Belgium.

Australian Year Book — The official year book for the Commonwealth of Australia, for 1924, pp. 1,096, is now available from The Official Secretary, Office of the Commissioner for Australia, 44 Whitehall St., New York City.

Iron, Zinc, and Marble in Tennessee—Down in Tennessee, where a law was recently passed prohibiting the teaching of the theory of evolution in the public schools, the Department of Education, Division of Geology, has recently issued three bulletins on the mineral resources of the state. Bulletin 28, by C. H. Gordon, T. Nelson Dale, and Oliver Bowles, 264 pages, is in three parts, covering the occurrence and distribution of the marble deposits of East Tennessee, the constitution and adaptations of the Holston marbles, and the technology of marble quarrying. Bulletin 29, "The Magnetic Iron Ores of East Tennessee and Western North Carolina," 252 pages, is by W. S. Bayley. Bulletin 31, by Mark H. Secrist, 156 pages, is entitled "Zinc Deposits of East Tennessee," and is especially concerned with the mines at Mascot.

Cooling Mine Air—J. H. Veasey has an 11-page paper on "The Cooling of Mine Air" in the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa, for January. Price, 3s. 6d.; Johannesburg.

South Australian Mining—The mining review for the half year ended June 30, 1924, Bulletin No. 40, 66 pages, is now available from the Department of Mines, Adelaide, South Australia.

Ontario Mining—Vol. 31, Part 1, of the thirty-first annual report of the Ontario Department of Mines, Toronto, 73 pages, contains a statistical review of 1921 by W. R. Rogers, and a short article by James Bartlett on gravel deposits of the St. Clair River. Obtainable on request.

Magnesium from Magnesia—Ichitaro Namari has written a book on "The Electrolytic Separation of Magnesium from Magnesia," 159 pages. The first 35 pages cover general information on the production, utilization, and properties of magnesia and magnesium. Then comes a report of the author's work on the production of metallic magnesium from magnesia or calcined magnesite by the electrolysis of magnesium chloride, and by the electrolysis of a mixture of magnesia and certain fluorides. The purpose of the research was to cultivate a field for the use of Manchurian magnesite. The book may presumably be obtained from the author at Sakai, Japan.

Activated Carbon—Ralph H. McKee and Paul M. Horton recently published a series of articles in *Chemical and Metallurgical Engineering* on activated carbon. Many of the data presented are of interest to metallurgists because this material is an important metal adsorbent. "Adsorbent Carbons for Many Industries" appeared in the Jan. 5 issue; "A New Class of Activated Carbons" in that of Jan. 12; and "Activated Char for Gold Adsorption" in the issue of Jan. 26. Obtainable for 25c. each from the McGraw-Hill Co., New York, N. Y.

Alaskan Mining—Bulletin 773-A of the U. S. Geological Survey, Washington, D. C., 69 pages, obtainable on request, contains a review of "Alaska's Mineral Resources and Production, 1923," by Alfred H. Brooks; "An Early Tertiary Placer Deposit in the Yentna District," by Stephen R. Capps; and an administrative report by Mr. Brooks. An appendix gives a list of all recent Survey publications on Alaska.

Index of Publications—The U. S. Bureau of Mines has published an index of the *Reports of Investigations* that have been issued by the Bureau during the last six years, in which time 662 of these bulletins have appeared. It was compiled by Harry E. Tufft and E. V. Brandenburg, and may be obtained from the Bureau of Mines, Washington, D. C. on request.

Mine Accidents—Bulletin No. 248 of the U. S. Bureau of Mines is a statistical study by William W. Adams of "Metal-mine Accidents in the United States During 1923." The death rate was the lowest ever recorded, owing to reduced fatalities at iron and gold-silver mines, but the non-fatal injury rate continued to rise. Obtainable for 15c. from the Superintendent of Documents, Washington, D. C. (90 pages.)

Patents Recently Issued

Metallurgy of Aluminum

No. 1,534,031. April 21, 1925. F. C. Frary, Oakmont, Pa., assignor to Aluminum Company of America, Pittsburgh. Alumina is melted, allowed to solidify, ground to about 85 mesh so that it will remain in suspension in a fused bath of cryolite until dissolved, and the solution then electrolyzed, with the deposition of metallic aluminum at the cathode.

No. 1,534,032. April 21, 1925. L. W. Gabriel, Badin, N. C., assigned as above. A method of testing a molten nonmetallic aluminous material by spreading some of it out in a thin layer, allowing it to cool, and observing characteristic colors on the surface exposed to the air.

No. 1,534,315. April 21, 1925. William Hoopes, Pittsburgh, assigned as above. The patent covers an electrolytically refined aluminum of at least 99.8 per cent purity, softer than all other base metals except tin and lead, equal to copper and exceeding tin in tensile strength, and capable of being immersed in dilute hydrochloric acid for a long time without material corrosion.

No. 1,534,316. April 21, 1925. William Hoopes, Pittsburgh, F. C. Frary, and J. D. Edwards, Oakmont, Pa., assigned as above. A combination smelting and electrolytic refining process for treating impure aluminous material to obtain metallic aluminum and iron-silicon-titanium alloys.

Nos. 1,534,317-8. April 21, 1925. William Hoopes, Pittsburgh, and F. C. Frary and J. D. Edwards, assigned as above. Details in the electrolytic refining of aluminum.

No. 1,534,319. April 21, 1925. William Hoopes and F. C. Frary, assigned as above. Electrolyzing a molten body of impure metal or alloy with a superimposed bath of aluminum fluoride, removing alumina from the bath as may be necessary to keep the bath saturated therewith.

Nos. 1,534,320-1. April 21, 1925. William Hoopes, assigned as above. Electrolytic cell design for producing aluminum.

No. 1,534,322. April 21, 1925. William Hoopes, J. D. Edwards, and B. D. Horsfield, of Badin, N. C., assigned as above. A process of producing a refractory insulating lining for an electrolytic cell.

No. 1,535,458. April 28, 1925. F. C. Frary, assigned as above. A method and apparatus for electrolyzing aluminous material.

Cyanide Manufacture—No. 1,534,054. April 21, 1925. G. H. Clevenger, Brookline, Mass., assignor to U. S. Smelting, Refining & Mining Co., Portland, Me. A process of synthetically producing cyanide by passing a stream of nitrogenous gas and vaporized metallic compound through a zone of incandescent carbonaceous material.

Thickening—No. 1,534,145. April 21, 1925. W. A. Stedman, Westport, Conn., assignor to The Dorr Co., New York. A method of hydraulically regulating the discharge from a thickener.

Refractory—No. 1,534,199. April 21, 1925. John Wilson, Crook, England, assignor to John Wilson and Pease and Partners, Ltd., Darlington, Durham, England. The manufacture of silica bricks containing about 2½ per cent of china clay and about 1½ per cent lime.

Concentrating Table—No. 1,534,224. April 21, 1925. R. A. Leahy, Bonne Terre, Mo. Reinforced soft rubber riffles for a concentrating table.

Petroleum Drilling—No. 1,534,414. April 21, 1925. T. M. Rogers and J. L. Kniffen, Fellows, Calif. A fishing tool.

No. 1,535,083. April 28, 1925. Paul Arbon, Tulsa, Okla. A drilling jar.

Waste Gases—No. 1,534,323. W. H. Howard, Salt Lake City, assignor to American Smelting & Refining Co., New York. Waste metallurgical gases are bypassed through a reducing agent before being discharged to the air.

No. 1,534,324. W. H. Howard, assigned as above. Arrangement of oil burners within a stack, near its base, for heating waste gases and increasing the velocity of discharge upward into the air.

Rock Drills

No. 1,535,143. April 28, 1925. R. H. Wilheim, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. Design of a mounting for rock drills.

No. 1,535,198. April 28, 1925. L. C. Bayles, Easton, Pa., assignor to Ingersell-Rand Co., Jersey City, N. J. An automatic rotation mechanism for rock drills.

No. 1,536,034. April 28, 1925. M. E. Thomas, Plano, Tex., assignor of three-fourths to G. G. Acree and one-fourth to H. N. Thomas, Plano, Tex. A drill bit adapted to be attached to a tubular rod, and having two disk-shaped cutting edges for rotary drilling.

Mineral Separator — No. 1,534,481. April 21, 1925. O. W. Alston, New Westminster, B. C. A cylindrical device for coating and collecting mineral grains.

Concentrator—No. 1,534,536. April 21, 1925. C. M. Meyer, San Francisco. A concentrator with an inclined element having intersecting diagonal grooves with dished bottoms.

Ore Reduction—No. 1,534,648. April 21, 1925. Ernst Knauer, Los Angeles. Wet ore is dried, formed into level layers, submitted to open flames for burning off combustible matter, at the same time being fanned to eliminate waste. Magnetic separation is then applied.

Vanadium Recovery—No. 1,534,819. April 21, 1925. R. H. von Seth, Stockholm, Sweden. A method of obtaining a rich vanadium slag in the refining of pig iron. This is to be described by the author in one of the coming issues of *Mining Journal-Press*.

Skimming—No. 1,535,202. April 28, 1925. Frederick Conlin, Westfield, N. J., assignor to trustees of estate of John T. Pratt, New York. A neutral or reducing gas jet is played on the surface of molten material to blow off the slag or residue.

Metallurgy of Zinc

No. 1,534,935. April 21, 1925. Ferdinand Fiechtl, Cherryvale, Kan., and William Kappellmann, St. Francois, Mo. Design for a vertical retort furnace.

No. 1,535,026. April 21, 1925. Hermann Mehner, Berlin-Charlottenburg, Germany. Zinc is volatilized in a reverberatory furnace by burning fuel above a bed of mixed ore and fuel, a part of the heated products of combustion being returned under the ore bed, up through which the hot gas passes to reduce and volatilize the zinc.

No. 1,535,059. April 21, 1925. Filip Tharaldsen, Bestum, near Christiania, Norway. Liquid zinc is made from blue powder by subjecting the powder to the revolving action of a rotary heated drum and imparting a series of shocks to the drum during rotation to cause a settling of the non-oxidized metal of the powder.

No. 1,535,252. April 28, 1925. Oystein Ravner, Christiania, Norway, assignor to Det Norske Aktieselskab for Elektrokemisk Industri, Christiania, Norway. Hot metal vapors are led from the furnace in which they are formed to a condensation chamber where they are quickly cooled and the metal liquefied to drops. Metal dust is precipitated by passing the liquid metal drops through the gas stream countercurrent to its flow.

Phosphate Separation—No. 1,535,120. April 28, 1925. S. B. Kanowitz, Greensburg, Pa., and H. A. Webster, Columbia, Tenn. Kanowitz assignor to Raymond Bros. Impact Pulverizer Co., Chicago. A method of air separation of high-content phosphate from low-grade phosphate and clay.

Roasting-furnace Rabble—No. 1,535,160. April 28, 1925. A. N. Jette, Anaconda, Mont. Design and method of cooling the rabble arms in mechanical roasting furnaces.

Powdered Coal for Blast Furnaces—No. 1,535,174. April 28, 1925. A. G. McGregor, Warren, Ariz. A method of introducing powdered fuel into a blast furnace by using the regular air blast, and increasing the pressure in the fuel tuyères sufficiently to force the fuel into the furnace against the pressure developed therein from the main air blast.

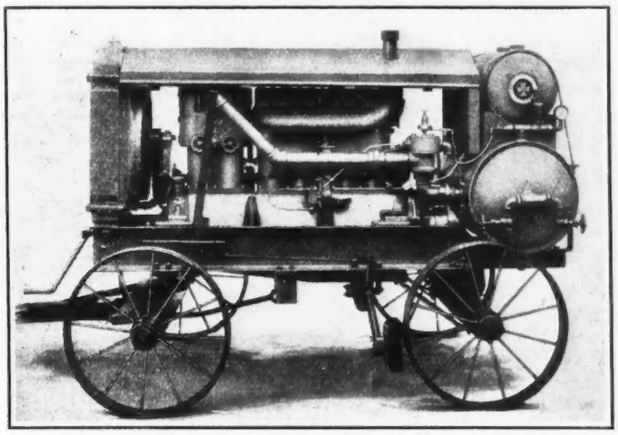
Sintering—No. 1,534,398. April 21, 1925. John Knox, Perth Amboy, N. J., assignor to Dwight-Lloyd Sintering Co., New York. Design of pallets and supporting units for sintering machines.

No. 1,535,695. April 28, 1925. H. L. Spence, Cleveland, assignor to National Malleable & Steel Castings Co., Cleveland. A grate bar for sintering machines, and method of support.

Mercury Extraction—No. 1,535,467. April 28, 1925. E. E. Hedges, New York, assignor to The Hedges New Eduction Process Corporation, Newark, N. J. Mercury is extracted from cinnabar by subjecting the ore to steam superheated above the vaporization point of mercury, air being excluded.

Patents are obtainable for 10c. *each only from the office of the Commissioner of Patents, Washington, D. C. "Mining Journal-Press" has none for sale.*

New Machinery and Inventions



A supercharger increases the efficiency of this light, portable air compressor to 85 per cent. Standardized parts are used throughout

Use of Supercharger Increases Compressor's Efficiency

A distinct novelty in light portable air-compressor units has just been designed and placed upon the market by the Rix Compressed Air & Drill Co., of San Francisco. The unit, known as the Rix-Six, is self-contained, and is mounted on a steel truck equipped with solid rubber-tired wheels and designed to be moved as a trailer.

The engine and compressor are in a single, compact unit, which is bolted directly to the channel irons of the frame of the truck. The weight of the complete unit is less than 2,000 lb., the over-all length of the truck and its accessories being only 7 ft. The compressor displacement is 118 cu.ft. of free air per minute at sea level, and net air delivery is approximately 100 cu.ft. of free air per minute, suitable for the operation of three paving breakers or two light hand-held drills similar to the Cochise No. 24, or equivalent sizes in other makes.

The unit is suitable for street work, trench digging, road work and especially for preliminary prospecting work where trenching, crosscutting, and drifting are necessary to determine the course, width, and downward extension of an outcrop. Its light weight renders it particularly convenient for moving over rough ground.

The engine is of the four-cylinder type; cylinders 4¾ in. x 6 in.; rating at 800 r.p.m., 28 hp. The magneto of the Splitdorf type and the 1-in. centrifugal pump are driven by a shaft and cut gears from the crankshaft. A Stromburg carburetor is placed close to the exhaust manifold. A Taco governor of the ball type driven by gears from the crankshaft throttles the gasoline supply and provides an efficient and reliable speed and power control. The motor or engine is manufactured by the Beaver Motor Co. of Milwaukee, Wis. It has been tried out by daily use since 1918, and is a rugged dependable motor. The forced-feed lubricating system is an important adjunct and insures against all lubricating trouble. Oil is received in the lower part of the crankcase, strained, and returned by a rotary pump to the circulating system. The engine is completely incased, is dust-proof and is equipped with overhead valves. Hand plates, sealed with cork gaskets, give access to the crankcase.

The compressor is of the two-cylinder, single-acting Rix type. The cylinders are 5¼ x 6 in. in dimension. Valves are of the plate type, all of the valve construction being of steel. The air cylinders are equipped with the patented supercharger, which is said to increase the compressor efficiency to 85 per cent, compared with the usual 70 to 73 per cent. The air-cylinder pistons are cast iron with bronze bushed and hardened wristpins. The piston rings are cast and step-cut. A 2-in. discharge unloader equipped with automatic engine slow-down is used, which effectively eliminates any possibility of excess oil being passed through the cylinders and into the receiver. Water-jacket space is ample for cooling purposes. The compressor is direct-driven, the usual clutch being eliminated. A flywheel on the end of the crankshaft insures steady operation of both motor and compressor. The crankcase of the compressor is a part of the crankcase of the motor.

A direct water-circulating system is used for both motor and compressor. The 1-in. circulating pump forces the water through the system to the radiator, which is of the tubular, four-row type, incased in a cast-iron body secured by Drake locknuts to the frame of the truck. No soldered joints are used on the radiator, which obviates the danger of pulling apart. The fan, leather-belt driven from the shaft of the pump, draws air through a tunnel from the radiator, discharging upon the compressor.

The air receiver is 20 in. in diameter by 42 in. long, and is of ample size for the compressor. The gasoline tank, mounted on top of the receiver, is of 20 gal. capacity, the consumption of gasoline being slightly over 2¼ gal. per hour at full load. The exhaust is of the vertical overhead type with buffer. A silencer can be added if necessary. Ball-bearing wheels for the running gear can be supplied also.

All bearings and parts are accessible. The elimination of clutch and coupling simplifies the machine and reduces its weight. Standardized parts reduce operating troubles to a minimum, making this portable outfit a dependable, reliable, and economical unit.

New Alloy Introduced for Bearings

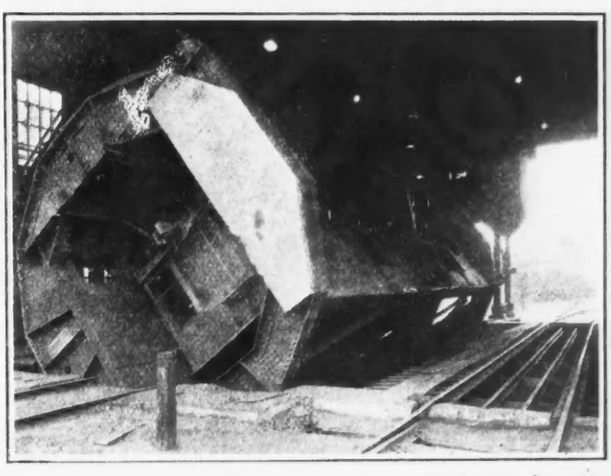
A new bearing alloy that is said to work to advantage whether compressed, die cast, or rolled has been introduced by J. E. Loudon & Co., Box 240, Boston, Mass. It has been tested for exhaust fan and punch press bushings, bearings for grinding-machine spindles, and other uses with good results, according to the manufacturer. The alloy is being sold under the name of Mahanite.

1,800 Tons per Hour Capacity of This Car Dumper

The electrically operated car dumper shown in the accompanying photograph, installed at the plant of the Donner-Hanna Coke Corporation, at Buffalo, N. Y., was designed and built by the Robins Conveying Belt Co. and was the second of its type to be built in the United States. Electric motors, built by the General Electric Co., rotate the dumper, operate the top hooks and side holders and also the automatic-control equipment and brakes.

The dumper is designed to handle any size of car from a 36-in. side to a 90-ton hopper car.

A new car dumper. The capacity of the conveying equipment taking coal away from the bin is about ten cars per hour. The dumper can handle twenty



The Market Report

Daily Prices of Metals

May	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
7	13.35	53.00	53.875	7.775	7.50@7.55	6.90
8	13.375	52.875	53.875	7.775	7.50@7.55	6.90
9	13.375	53.00	54.00	7.775	7.55@7.625	6.90
11	13.375	53.50	54.50	7.775	7.60@7.625	6.90@6.95
12	13.375	53.50	54.50	7.80	7.65@7.70	6.95@7.00
13	13.325@13.375	53.50	54.50	7.80	7.65@7.70	6.95@7.00
Av.	13.367	53.229	54.208	7.783	7.600	6.929

*The prices correspond to the following quotations for copper delivered: May 7th, 13.60c.; 8th, 9th, 11th, and 12th, 13.625c.; 13th, 13.575@13.625c.

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

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

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

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

London

May	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
7	59 7/8	60 7/8	63 1/2	240 1/8	242 1/4	31 7/8	31 3/8	34 1/8	33 1/8
8	60 1/4	61 1/8	63 1/2	239 5/8	242	32 3/16	31 11/16	34 1/8	33 3/8
11	60 1/2	61 1/2	64	243 3/4	245 3/4	32 1/8	32 1/8	34 1/4	33 7/16
12	60 1/4	61 1/8	63 3/4	242 3/4	244 3/4	32 11/16	32 3/16	34 3/8	33 5/16
13	60 1/4	61 1/4	63 3/4	243 1/4	245 1/4	32 3/16	31 13/16	34 1/4	33 7/16

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

May	Sterling Exchange "Checks"	Silver		Gold London	May	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
7	4.84 5/8	67 3/4	31 3/8	84s 11d	11	4.84 1/2	67 5/8	31 3/8	84s11d
8	4.84 5/8	67 3/4	31 3/8	84s 11d	12	4.84 5/8	67 1/2	31 1/4	84s11 1/2d
9	4.84 3/8	67 7/8	31 1/2	.....	13	4.84 1/2	67 1/8	31 1/16	84s11 1/2d

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

Non-ferrous Metals Quiet; Principal Activity in Lead

New York, May 13, 1925—Metal producers have not been anxious to sell; consumers have not been anxious to buy. This has been the condition of the metal market during the week. With the single exception of lead, the metal markets have been dull and only moderately active. Prices, however, have held fairly steady, especially of copper and zinc, but lead, under the stimulus of increased buying from manufacturers, has advanced in price. The course and feeling of the London market continues to have a decided influence over the market in New York and other basing points. Antimony has taken a sharp jump upward in price.

Copper Has a Dull Week

Sales of copper have been light. Several producers were completely out of the market lately, but have not lost much business as a consequence. Copper held fairly firm at 13⅝c. delivered for most of the week, but today a concession of five points was made in a moderate tonnage. Considerable interest was aroused by the inquiry of a large telegraph company for 1,000 tons of copper yesterday. The ultimate disposition of this order remains undetermined, and it may not have been placed directly with a producer, but with a wire or rod mill. Consumption of copper is splendid by the domestic manufacturing industries. Export demand has also been good, with Germany and England remaining the chief buyers. Some producers have been so well satisfied with their export sales that they have not quoted on any domestic inquiries. There has been a slight falling off in the export demand in the last few days. For the time being copper seems to have reached a level satisfactory to both consumers and producers, for both are pursuing a waiting policy.

Lead Higher, With May Supplies Scarce

The contract price for New York lead, set by the American Smelting & Refining Co., continues at 7.75c.

The good demand for lead which has characterized the metal markets since April 22 continued in the week ending today. Those producers who had any lead made comparatively large sales, but some found themselves so well sold up, or had their production so well covered by specifications on contracts, that they had little to offer. The amount of May lead remaining in the hands of producers is getting very small, and in the last few days premiums have been obtained in some instances for May shipment over that for June. In the last day or two, however, there have been indications that consumers have now pretty well provided for their immediate requirements, so that a squeeze in spot lead seems unlikely. A sizable tonnage of June lead has already been sold, but there is still plenty available from most producers. Neither consumers nor producers are interested in dealing in lead for July delivery or later.

The demand for lead has been well distributed among the various classes of consumers, though cable companies have been perhaps a little more active than usual. The situation is most favorable from all standpoints. There seems to be a domestic demand for all the home production; should this demand increase, ore lead from Mexico could be sold in the United States at only slightly higher prices than are now asked, thus meeting any deficiency, though at the expense, of course, of the foreign supply, which has shown few, if any, signs of abating.

The differential between St. Louis and New York prices is smaller than for some time. It must be realized, however, that most of the lead going to consumers in the East is sold by the leading producer at his contract price, and that prices in the open market, or for shipment from the West, are considerably above 7.75c. Thursday or Friday 7.80@7.85c., New York, could be done, but in the last day or two a few small orders have been booked at 7.95c. Several dealers have been actively in the market for the metal, with producers disinclined to sell, as usual in a market of this kind.

Galvanizers Uninterested in Buying Zinc

With the galvanizers exhibiting only a small interest in purchasing Prime Western zinc, producers have not made any sales worth talking about. Galvanizers are reported to be working about 60 per cent of capacity now. The market has varied between 6.90 and 7c. during the week. Some sales of zinc were made, to Europe principally —England, Germany, and Italy—but a portion of the sales made for arbitrage, or covering transactions here, were of a more or less speculative nature. Until the galvanizers come into the market again prices will be listless in St. Louis. The galvanizers are said to have been affected recently by much price cutting among themselves.

The statistics of the American Zinc Institute for April show only a light increase in stocks as follows:

April Zinc Statistics, in Short Tons

Stock, April 1	17,196
Produced	48,851
	66,047
Shipped	47,710
Stock, April 30	18,337
Shipped from plant for export	5,905
Stored for customers	67
Retorts operating, April 30	86,674

Tin Marks Time

Fluctuations in the tin market have been remarkably narrow during the week, with the market for spot Straits stabilized at about 54½c. the last three days. Sales have not equaled consumption. Forward shipment has ruled from ⅛ to ¼c. under the prices of spot.

Silver Lower

During the first few days of the last week silver both in London and New York was steady and even seemed strong on active buying for China account. Since Monday, however, short selling, with less interest by buyers, has resulted in a decline, which brought the price of silver in London today to the lowest level since April 29. India has not lately been an active buyer in this market, which appears to be steady at today's quotation, and a reaction might easily take place.

Mexican Dollars: May 7th and 8th, 52¼c.; 9th, 52¼c.; 11th and 12th, 52c.; 13th, 51⅞c.

Exchanges Quiet

Foreign exchanges have been quiet. Closing cable quotations on Tuesday, May 12, were as follows: francs, 5.2075c.; lire, 4.105c.; and marks, 23.81c. Canadian dollars, ⅜ per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, £125.

Antimony—

Chinese brands, 15@17½c. per lb.

Cookson's "C" grade 18½c.

Chinese needle, lump, nominal, 10c.

Standard powdered needle, 200 mesh, 11½@13c.

White oxide, Chinese, 99 per cent Sb_2O_3, 16c. nominal.

Bismuth—$2 per lb., in ton lots. London, 7s. 6d.

Cadmium—60c. per lb. London, 2s. 3d.@2s. 4d.

Iridium—$375@$400 per oz. London £70.

Nickel—Ingot, 31c.; shot, 32c.; electrolytic, 38c.; London, £172½ per long ton.

Palladium—$79@$83 per oz. London £17½.

Platinum—$120 per oz. refined. London, £25 per oz.

Crude, $115.

Quicksilver — $80@$81 per 75-lb. flask. San Francisco wires $82.35. Quiet. London £13½.

The prices of **Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmiridium, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten,** and **Zirconium** are unchanged from the prices given in the May 9 issue.

Metallic Ores

Tungsten Ore—Per unit, N. Y.:

High-grade wolframite $11@$11.50 per unit. Ordinary quality, $11. Scarce.

High-grade Western scheelite, $11 nominal.

Chrome, Galena Radio Crystals, Iron Ore, Manganese, Molybdenum, Tantalum, and **Vanadium Ores** are unchanged from May 9 quotations.

Zinc Blende Higher—Lead Ore May Advance

Joplin, Mo., May 9, 1925

Zinc Blende	Per Ton
High	$53.85
Premium, basis 60 per cent zinc	$50.00@$52.00
Prime Western, 60 per cent zinc	$48.50
Fines and slimes	$47.00@$45.50
Average settling price, all ore	$46.34

Lead Ore	
High	$105.30
Basis 80 per cent lead	$90.00
Average settling price, all ore	$93.27

Shipments for the week: Blende, 14,444; lead, 2,100 tons. Value, all ores the week, $865,230.

Buyers report up to 5 o'clock this afternoon that $48.50 is the level of prices for Prime Western grades of zinc, but many sellers have declined this price and are asking a $50 basis. It is intimated that some buyers may yet meet the holding price, if a compromise on $49 cannot be effected.

An admission that lead might advance today was made by one buyer, although no sales have been reported above that level at 5 o'clock. In fact, few purchases of lead have been made. Restricted production has lowered the output, and sellers are selling slowly and are asking an advance.

Zinc-ore production this week is estimated around 13,400 tons, approximately 3,500 tons less than the maximum production.

Platteville, Wis., May 9, 1925

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$50

Lead Ore	
Lead, basis 80 per cent lead	$95

Shipments for the week: Blende, 1,041 tons; lead, 30 tons. Shipments for the year: Blende, 13,878; lead, 737 tons. Shipments for the week to separating plants, 1,406 tons blende.

Production has been lowered to around 14,000 tons per week, a decrease from the high level of about 3,000 tons per week.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Beryl, Borax, Celestite, Chalk, China Clay, Corundum, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Ozocerite, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from May 9 prices.

Mineral Products

Arsenious Oxide (white arsenic)—5½c. per lb. A few carloads sold.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and **Zinc Oxide** are unchanged from May 9 prices.

Ferro-Alloys

Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferrouranium and **Ferrovanadium** are unchanged from the prices given in the May 8 issue.

Metal Products

Copper Sheets—Base price 21.75c. Wire, 15.875c.

Nickel Silver, Yellow Metal, Zinc Sheets and **Lead Sheets** are unchanged from the issue of May 9.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick, and **Zirkite** are unchanged from May 9 prices.

Steel Prices Remain Firm

Pittsburgh, May 12, 1925

The Steel Corporation's unfilled obligations decreased 416,996 tons in April, against 421,207 tons decrease in March, the seven preceding months having shown increases. Steel ingot production in April was at 79.5 per cent of capacity, against 93 per cent in March, the high month. Production in the four months of the year made a new high record for four consecutive months.

Pig Iron—The market remains stagnant. Prices have been practically nominal of late, at $21 for bessemer and $20 for basic or foundry, f.o.b. Valley furnaces.

Connellsville Coke — Production is now less than half the peak rate of early in the year. Buying is insignificant. Spot furnace, $3@$3.15; spot foundry, $4@$4.50.

Quiet Metal Markets in Germany

By Dr. James Rubinfeld, Charlottenburg, Germany

Those people pondering about the fact of this year's slump in metals and its reasons are at a loss to determine whether the real causes of the setback lie in America or in Europe, especially in the German credit situation. Though no doubt the increase of copper output from lean ores, the threat of Katanga, free competition of producers themselves, and dearer money in the United States are responsible, the other chief factor may be Germany. Arrivals of copper in Germany are heavy, approaching pre-war shipments. In January, according to official statistics, they amounted to about 18,500 tons, and in February more than 20,500 tons came in, to which may be added such material as entered across the western and Danish frontier. The Federal Postal Department is planning to enlarge its cables by 6,000 km., but there is no pressing need for electrolytic copper.

Rolling mills and metal manufacturers of Germany work up their scrap and residues to refined and electrolytic in a much larger measure than anywhere else, with the result that when, as at present, copper arrivals are abundant, cathodes are ordered with refineries and thus, seemingly, plenty of electrolytic copper is in the market. Many American representatives of copper producing companies are striving to capture the German market, sometimes underbidding one another in drastic manner by one-fourth to one-half of a cent a pound. On the other hand, dealers and jobbers are compelled to liquidate stocks to meet current obligations.

Because of the habit of German dealers in copper and other metals to practice arbitrage in handling the metal they hold, so as to get trading profits through price fluctuations, a general selling of copper occurs when the weak tendency in New York becomes apparent. This leads also to a decrease in ore imports, because importers fear losses. For instance, imports of lead ores amounted in February, 1925, to only 636 metric tons against 4,087 in February, 1924; to 816 metric tons of copper ores, against 1,950.7 in February, 1924; further only 1,159 metric tons of tin ores were imported, against 431. Zinc ores, which are handled by the Syndicate of Kattowitz (which precludes speculative operations in the true sense of the word) and Mexican ores have been imported in larger quantity than in February, 1924. There is reason to believe that the setback in German demand synchronizes with forward speculations in terms of French francs, although this is discussed but little (as a consequence of fears of another Morgan intervention).

The European copper situation centers in the inability of German traders and users to hold their stocks—that is, to finance them; and possible American credit payment notices or withdrawals in the near future create some apprehension. This danger looms large, for the bonded loan to such copper users as Allegemeine Elektrizitäts-Gesellschaft and Siemens & Halske is thus far a drop in the bucket. So long as German metal manufacturers are unable to grant longer credits to their overseas customers, for fear of short notices from the United States, they are obliged to operate on a hand-to-mouth basis and to liquidate stocks instead of preserving them. The German example is contagious for the whole of Europe.

A device of trading circles here to cure credit stringencies is the establishment of the futures metal trade on the Metal Exchanges of Berlin and Hamburg, which began on April 20, 1925. In Berlin not fewer than 200 brands of copper, including obsolete ones, as Bede or Wallaroo, or even rough copper, are being dealt in four months ahead; also a great many lead brands, including "Berliner Blei" (a secondary metal), while at Hamburg, copper and tin futures are dealt in to a considerable extent. In the opinion of the boards, forward business is to be not only a makeshift by affording possibilities of covering operations in case of a lack of ready currency, but also a means by which ultimately the German metal trade is to recover its former competition with the London Exchange, for it is regarded an absurdity that the largest consuming country is strictly dependent upon quotations made by London dealers and jobbers. Nevertheless, standard copper remains the basis of operations in copper futures, the latter being defined as in London, and other grades carrying discounts or premiums, respectively. Though British warehouse warrants are good delivery regarding copper, in the case of lead only German and Rotterdam warrants are admissible, the opinion being that lead stocks of Great Britain are always small, and do not justify their acknowledgment in covering operations. The clearing bank of the Berlin Metal Exchange is the big Commerz und Privat Bank, with which margins and advances are negotiated. Quotations are call quotations, which are made at 1: 30 p.m. The possibility of arbitrage business is restricted to copper for London, Berlin, and Hamburg, whereas the contract basis of lead differs widely in so far as the minimum quantity of Berlin is ten tons, against twenty-five tons in London.

The aluminum Inn-Werk is now in full operation, with the result that very little foreign material is required, and this situation will probably improve further. The present aluminum production of the Lautawerke, the Erftwerk, and Inn-Werk may be estimated to be 30,000 tons a year or thereabouts.

The second mintage of silver coins, which according to government regulation are to contain 500 parts copper and 500 parts silver, has been taken up, and no appeal was made for additional silver to the free silver market, because the Reichsbank stocks sufficed. A change in the Bourse provisions with respect to the content of silver bars forming a good delivery is under consideration, by which (in the same way as in London and New York) only 999 fine will be an acceptable delivery.

Company Reports

Miami Copper Co.

Miami Copper Co.'s report for 1924 states that during 1925 it is proposed to begin mining and treating the low-grade sulphide ore, and to that end the work is now under way of enlarging the plant so that 10,000 tons of ore may be treated daily, or 3,600,000 tons per annum. It is expected that this low-grade ore will yield 14 lb. of refined copper per ton, thus giving an annual production of about 50,000,000 lb.

No economical method of treating the mixed sulphide and oxide ore has been worked out, so that the mine for the present must depend for its production of copper upon the balance of the available high-grade sulphide ore and the low-grade sulphide.

On Jan. 1, 1925, ore reserves were as follows:

	Tons	Per Cent of Copper
High-grade sulphide ore	4,035,505	2.08
Mixed sulphide and oxide ore	6,000,000	2.00
Low-grade sulphide ore	36,000,000	1.06

Though some good ore was encountered in the exploratory work which has been conducted east of the Miami fault, no body of merchantable ore large enough to warrant exploitation has been found.

Balance Sheet

Assets

Property		$26,545,119.58
Development		1,333,717.09
Construction and equipment		2,890,561.28
Ore and metals on hand		2,330,357.61
Sundry materials and supplies		858,526.00
Prepaid taxes, insurance, and expenses		14,614.04
Accounts receivable		359,804.76
Cash		578,278.73
U. S. Government certificates and notes		2,136,373.42
Other investments and securities		1,102,529.01
		$38,149,881.52

Liabilities

Capital stock			$3,735,570.00
Accounts payable			797,576.17
Reserve for ore depletion			
Balance, Jan. 1, 1924		$18,492,048.37	
Ore depletion for 1924		2,091,491.07	20,583,539.44
Surplus account			
Balance, Jan. 1, 1924		$15,507,909.32	
Transferred from profit-and-loss account		1,111,005.66	
		$16,618,914.98	
Less			
Dividends Nos. 46-49	$1,494,228.00		
Transferred to ore depletion account	2,091,491.07	3,585,719.07	13,033,195.91
			$38,149,881.52

Operating Account

	Per Pound	
Mine development, 2,444,079 tons	$0.0125284	$757,664.49
Mining expense, 2,444,079 tons	.0331188	2,002,874.45
Milling expense, 60,475,547 lb.	.0257352	1,556,352.73
General expenses at mine	.0109230	660,572.90
Freight on concentrates	.0068344	413,312.87
Smelting, refining and freight	.0171595	1,037,729.48
Legal expense	.0007287	44,071.54
New York office expenses and taxes	.0027718	167,622.98
Selling expenses, freight discount, and commissions	.0028205	170,573.06
	$0.1126203	$6,810,774.50
Less rentals, and sales of power	.0003371	20,385.93
	$0.1122832	$6,790,388.57
Balance carried down		1,168,008.76
		$7,958,397.33

	Pounds			
Deliveries of copper	61,732,541	@$0.1296748		$8,005,158.38
Less on hand 1/1/1924	21,136,912	@ .1116054		2,358,993.66
	40,595,629			$5,646,164.72
Plus on hand 12/31/1924				
Refined copper sold	3,981,587	@$0.1323887	$527,117.13	
In process	15,898,331	@ .1122832	1,785,115.48	2,312,232.61
	60,475,547			$7,958,397.33

Profit-and-Loss Account

Depreciation charged off during year		$424,520.06
Difference in value of securities		2,883.33
Balance carried to balance sheet		1,111,005.66
		$1,538,409.05
Balance brought down		$1,168,008.76
Interest		131,201.66
Dividends received		239,198.63
		$1,538,409.05

Braden Copper Mines Co.

Copper; Chile

Braden Copper Mines Co., in its 1924 report, gives reserves of 254,716,144 tons, averaging 2.24 per cent copper.

Production was as follows:

Quarter	Tons Blister Copper Produced	Dry Tons Ore Treated	Daily Average	Per Cent in Ore Treated	Per Cent Plant Recovery
1st	20,962	1,089,383	11,971	2.308	81.57
2nd	18,702	977,879	10,746	2.315	80.29
3rd	17,583	986,389	10,722	2.376	78.81
4th	21,132	1,165,609	12,670	2.359	78.43
1924	78,379	4,219,260	11,528	2.340	79.78

Statement of Assets and Liabilities, Dec. 31, 1924

Assets

Property, construction, equipment and development		$36,900,435.36
Investment—Sherman Steamship Co.		575,480.13
Bond deposit account		25,000.00
Current and working assets:		$47,053,805.40

Liabilities

Capital stock issued—Braden Copper Mines Co.		$12,953,530.00
Kennecott Copper Corporation—loan account		15,874,550.00
Kennecott Copper Corporation—bond loan account		255,000.00
South American Products Corporation—advances		1,668,390.95
Loan from subsidiary company		140,000.00
Accounts payable		820,163.68
Unpaid expenses on copper		5,169.27
Drafts payable		206,051.58
Deferred credits in suspense		172,419.20
Reserve for insurance		199,617.95
Net deficit from operations	$2,007,266.09	
Depletion reserve	16,766,178.86	14,758,912.77
		$47,053,805.40

Combined Statement of Income

Operating revenue:		
Copper sold and delivered—152,619,829 lb. @ 12.984c.		$19,816,851.79
Gold and silver		48,497.40
		$19,865,349.19
Operating costs:		9,680,328.25
Operating profit		$10,185,020.94
Miscellaneous income		70,853.83
Total income		$10,255,874.77
Charges against income, taxes, etc.		1,486,362.56
Net income for year—carried to surplus account		$8,769,512.21

Combined Statement of Surplus Account

Deficit as stated—Dec. 31, 1923		$3,822,621.08
Net income for year—as above		8,769,512.21
		$4,946,891.13
Charges against surplus—1924, mainly depletion		6,954,157.22
Deficit—Dec. 31, 1924		$2,007,266.09
Depletion reserve—Dec. 31, 1924		16,766,178.86
Net combined surplus and depletion reserve, Dec. 31, 1924		$14,758,912.77

Anaconda Copper Mining Co.

Gross income from sales and royalties for 1924 of Anaconda and subsidiaries amounted to $166,467,901.80. Operating profit and income from investments amounted to $21,744,965.25. Net profit, after deducting all charges, depreciation, bond discount, and other charges, amounted to $6,719,215.49.

Production of the numerous Anaconda units was as follows:

Butte: 3,092,151 tons ore; 6,654 tons copper precipitates.

Anaconda Reduction Works: 3,312,774.7 tons ore treated; 238,823,149 lb. copper, 8,383,591 oz. silver, 37,688.8 oz. gold.

Great Falls Copper Refinery: 209,966,554 lb. cathodes.

Raritan Copper Works: 406,548,498 lb. copper, 20,037,558 oz. silver, 117,520 oz. gold.

Great Falls Wire and Rod Mill: 107,931,230 lb. of rods.

Anaconda and Great Falls Zinc Reduction Works: 599,275 tons ore (541,046 tons purchased).

Electrolytic Zinc Plant, Great Falls: 154,390,391 lb. zinc, 5,433,330 lb. zinc dross, 23,810,201 lb. lead, 1,892,097 lb. copper, 3,628,862.5 oz. silver, 5,603.7 oz. gold.

Arsenic, 11,196,409 lb.; sulphuric acid, 46,396.9 tons.

Phosphate, 43,201 tons rock, (31.87 per cent P_2O_5).

Copper plant International Smelter, Utah: 28,378,326 lb. copper, 1,841,984.4 oz. silver, 19,879.4 oz. gold. Lead plant—75,967,432 lb. lead, 3,897,138.6 oz. silver, 8,146.5 oz. gold.

Miami Smelter, Ariz.: 185,351,537 lb. copper, 410,937.35 oz. silver, 7,749.7 oz. gold.

International Lead Refinery: 105,637,507 lb. lead, 5,930,688 lb. antimonial lead, 5,907,412 oz. silver, 18,112.9 oz. gold.

Zinc oxide, 41,884,095 lb.; white lead, 13,757,905 lb.

Walker Mining Co., Calif.: 25,747.35 tons concentrates, 12,659,429 lb. copper, 217,764 oz. silver, 8,216.4 oz. gold.

Arizona Oil Co.: 353,026 bbl. oil.

American Brass Co.: 519,749,665 lb. copper, brass and nickel silver (record) Chile Copper Co.: 217,388,000 lb. copper.

Consolidated Balance Sheet Dec. 31, 1924

Assets

Fixed		
Mines, reduction works and refineries	$129,375,264.61	
Buildings and machinery	117,609,951.15	
Investments in sundry companies	98,441,422.90	$345,426,638.66
Deferred charges and discount on bonds		12,791,606.31
Current		
Supplies on hand and advances	$18,859,538.30	
Metals and manufactured products	46,645,598.28	
Accounts receivable	19,429,768.96	
Marketable securities	9,332,105.90	
Cash	7,263,674.35	101,530,685.79
		$459,748,930.76

Liabilities

Capital stock		
Issued, 3,000,000 shares		$150,000,000.00
Minority interest in subsidiary companies		2,014,113.49
Bonds outstanding		174,988,000.00
Reserve for depreciation		34,447,511.83
Current		23,778,640.38
Surplus		
Balance Dec. 31, 1923	70,051,449.57	
Net income for 1924	6,719,215.49	
	$76,770,665.06	
Deduct, dividend No. 86	2,250,000.00	74,520,665.06
		$459,748,930.76

Consolidated Income Account

Expense

Metals and manufactured products in process and on hand at beginning of year		$46,402,342.61
Ores and metals purchased		48,601,217.26
Mining, reduction, and refining of metals		41,881,198.30
Manufacturing expenses, including selling		56,111,299.65
Cost of merchandise sold and operation of public service companies		2,171,563.30
Administration and federal taxes		1,893,190.13
Balance carried down		16,052,688.83
		$213,113,500.08

Income

Sales of metals and manufactured products		$157,657,106.63
Tolls, royalties and rentals		5,989,509.70
Sales of merchandise and revenue from public-service companies		2,821,285.47
Metals and manufactured products in process and on hand at end of year		46,645,598.28
		$213,113,500.08
Depreciation and obsolescence		$4,231,422.51
Interest, including discount on bonds, less income from marketable securities		10,806,001.08
Balance, net income		
Carried to balance sheet	$6,719,215.49	
Apportioned to minority interest (loss)	11,673.83	6,707,541.66
		$21,744,965.25
Balance brought down		$16,052,688.83
Income from investments in sundry companies		5,692,276.42
		$21,744,965.25

Mining Stocks—Week Ended May 9, 1925

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Anaconda	New York	37⅜	35⅞	36⅝	Ap.16, My.23, 0.75
Arcadian Consol.	Boston	1 1/16	1¼	1¼	
Ariz. Com'l	Boston	10¼	10	10	Ja. 19, Ja. 31 0.50
Calaveras	N. Y. Curb			1¼	
Calumet & Arizona	New York	48¾	47¼	48	Mh.6, Mh.28 Q 0.50
Calumet & Hecla	Boston	13⅜	13	13	Ja.30, Mh.4 0.50
Canario Copper	N. Y. Curb	4½	3⅜	4½	
Cerro de Pasco	New York	47⅜	46	47¼	Ap.23 My.1, Q 1.00
Chile Copper	New York	32⅞	32	32½	Jn.3, Jn.29, Q 0.62½
Chino	New York	20⅛	19	20	Sept., 1920 0.37½
Con. Coppermines	N. Y. Curb	2⅞	2½	2⅝	
Copper Range	Boston	22	20⅛	20½	Ap.9, My.4 1.00
Crystal Copper	Boston Curb	*64	*59	*61	
East Butte	Boston	3⅞	3½	3½	Dec., 1919 0.50
First National	Boston Curb	*25	*18	*22	Feb., 1919 0.15
Franklin	Boston	*75	*75	*75	
Granby Consol	New York	14⅛	13⅛	14	May, 1919 1.25
Greene-Cananea	New York	12⅛	12⅛	12⅛	Nov., 1920 0.50
Hancock	Boston			*75	
HoweSound,new,r. t.c.	N. Y. Curb	16	15⅞	16	April, 1924 0.05
Inspiration Consl.	New York	24⅛	22½	23⅜	De.20, Ja.7, Q 0.50
Iron Cap	Boston Curb	1½	1 5/8	1½	May, 1923 0.15
Isle Royale	Boston	13	11⅜	12½	Sept., 1923 0.50
Jerome Verde Dev	N. Y. Curb	1⅛	1⅛	1⅛	
Kennecott	New York	50⅛	48	48⅜	Mh.6, Ap.1, Q 0.75
Lake Copper	Boston	1½	1⅜	1⅜	
Magma Copper	NewYork	40⅜	38½	39⅛	Jn. 15, Jy. 15, 0.75
Mason Valley	N. Y. Curb	1⅜	1⅜	1⅜	
Mass Consolidated	Boston	*55	*55	*55	Nov., 1917 1.00
Miami Copper	New York	7⅛	8⅛	8¼	My.1 My.15 Q 0.25
Mohawk	Boston	29	28	28	My. 2, Jn. 2 1.00
Mother Lode Coa.	New York	6⅞	6	6⅞	De. 12, De. 31 0.37½
Nevada Consol.	New York	12⅜	12	12⅛	Sept., 1920 0.25
New Cornelia	Boston	20	19⅛	19⅛	My. 8, My. 25Q 0.25
North Butte	Boston	1⅛	*95	1⅛	Oct., 1918 0.25
Ohio Copper	N. Y. Curb	*85	*75	*85	No.14, De.2 0.05
Old Dominion	Boston	19⅛	18⅜	19⅛	Dec., 1918 1.00
Phelps Dodge	Open Mar.	†108	102		Mh 20, Ap.2 Q 1.00
Quincy	Boston	22⅛	21	22⅛	Mar., 1920 1.00
Ray Consolidated	New York	12⅜	11⅛	12⅛	Dec., 1920 0.25
Ray Hercules	N. Y. Curb			14	
St. Mary's Min. Ld.	Boston	32	29⅛	31	Ap. 20, My.20, 3.00
Seneca Copper	New York			⅛	
Shannon	Boston	*65	*55	*55	Nov., 1917 0.25
Shattuck Arizona	New York	5⅞	5⅞	5⅞	Jan., 1920 0.25
Superior & Boston	Boston	*99	*99	*99	
Tenn. C. & C.	New York	9⅛	9⅛	9⅛	De.31, Ja.15,Q 0.25
United Verde Ex.	N. Y. Curb	23	22⅜	22⅜	Ap. 3, My. 1 0.50
Utah Copper	New York	87⅛	86	86½	Mh.20,Mh.31,Q 1.00
Utah Metal & T.	Boston			*50	Dec., 1917 0.30
Victoria	Boston			*40	
Walker Mining	Salt Lake	2.55	2.52½	2.55	
NICKEL-COPPER					
Internat. Nickel	New York	30⅜	29	29	March, 1919 0.50
Internat. Nickel pfd.	New York	97	96	97	Ap.16, My.1, Q 1.50
LEAD					
Carnegie Lead & Zinc	Pittsburgh	6	5⅜	5⅜	
Gladstone M. M. Co.	Spokane	*25⅜	*22	*25½	Ap. 1925 0.00½
National Lead	New York	148	139½	147½	Mh.13,Mh.31,Q 2.00
National Lead pfd.	New York	117	117	117	My.22, Jn.15 Q 1.75
St. Joseph Lead	New York	49	47¾	48	Mh. 5, Mh. 20 0.50
ZINC					
Am. Z. L. & S.	New York	8⅛	7⅛	7⅛	May, 1920 1.00
Am. Z. L. & S. pfd.	New York	27	26½	27	Nov., 1920 1.50
Butte C. & Z.	New York	5⅜	5⅛	5⅛	De.10, De.24 0.50
Butte & Superior	New York	9⅛	6⅜	8⅛	Mh.19, Mh.31 0.50
Callahan Zn-Ld.	New York	2⅞	2⅛	2⅛	Dec., 1920 0.50
New Jersey Zn.	N. Y. Curb	184⅜	181	184¼	Ap.20, My.9 2.00
United Zinc	N. Y. Curb			*35	
Yellow Pine	Los Angeles	*70½	*69	*69	De.10,De.15 Q 0.04
GOLD					
Alaska Juneau	New York	2⅛	1⅞	1⅞	
Argonaut	Toronto	*29	*22½	*28⅜	
Carson Hill	Boston			*15	
Consol. W. Dome L.	Toronto	*14	*12½	*13⅜	
Cresson Consol. G.	N. Y. Curb	3⅛	3⅛	3⅜	Mh.31, Ap.10 Q 0.10
Crown Reserve	Toronto	*37	*34	*36½	Jan. 1917 0.05
Dome Mines	New York	13⅞	13⅛	13¾	Mh.31,Ap.20,Q 0.50
Golden Cycle	Colo. Springs	1.43	1.43	1.43	Dec.11, 1924 0.03
Hollinger Consol.	Toronto	14.70	14.50	14.60	My.4,My.20, 1.00
Homestake Mining	New York	45½	44½	44⅞	My.2, My.20 M 0.50
Jib. Consol.	N.Y. Curb			*7	
Kirkland Lake	Toronto	*42½	*40½	*42	
Lake Shore	Toronto	5.80	5.47	5.76	Mh.2, Mh.16, 0.05
McIntyre-Porcupine	New York	17¼	16½	17⅜	My.1, Jn.1, 0.25
Newray	Toronto	*20	*20	*20	
Night Hawk Pen.	Toronto	*25	*24½	*24½	
Portland	Colo. Springs	*42½	*42½	*42½	Oct., 1920 0.01
Rand Mines	New York	37⅛	37⅛	37⅛	Fe.17, Fe.25 1.79
Teck-Hughes	Toronto	1.39	1.37	1.38	
Tom Reed	Los Angeles	*60	*55½	*60	Dec., 1919 0.02
Tough-Oakes	Toronto	*26½	*26	*26½	
United Eastern	N. Y. Curb			*50	July, 1924 0.05
Vipond Cons.	Toronto	1.21	1.17	1.20	
Wright-Hargreaves	Toronto	4.50	4.35	4.45	Mh.16,Ap.1,QX 0.05
GOLD AND SILVER					
Black Oak	N. Y. Curb			*81	
Con. Cortes	N. Y. Curb	*9	*9	*9	
Con. Virginia	San Francisco	*6½	*5½	*6½	
Continental Mines	N. Y. Curb	1¼	1¼	1¼	
Dolores Esperanza	N. Y. Curb			*45	July, 1923 0.05
Premier Gold	N. Y. Curb	2 7/16	2 5/16	2⅜	Mh.23, Ap.3, 0.08
Tonopah Belmont	N. Y. Curb	*65	*54	*65	Mh.15, Ap.1 0.05
Tonopah Divide	N. Y. Curb	*22	*22	*22	Se. 22, Oc. 10 0.10
Tonopah Extension	N. Y. Curb	2⅛	2	2 1/16	Mh.11, Ap.1, Q 0.05
Tonopah Mining	N. Y. Curb	3⅛	2⅛	3	Mh.31, Ap. 21, 0.07½
Unity Gold	N. Y. Curb	*50	*50	*50	
West End Consol.	N. Y. Curb			*26	Mar., 1923 0.05
Yukon Gold	N. Y. Curb	*40	*40	*40	June, 1918 0.02

Stock	Exch.	High	Low	Last	Last Div.
SILVER					
Alvarado	Boston Curb	*50	*50	*50	Oct. 1920 0.50
Beaver Consol.	Toronto	*31½	*30½	*31½	May, 1920 0.03
Castle-Trethewey	Toronto	*77½	*76	*77	
Coniagas	Toronto	1.50	1.45	1.45	May, 1924 0.12½
Keeley	Toronto	1.89	1.85	1.88	Mh.1, Mh.15SA 0.12
Kerr Lake	N. Y. Curb	1⅜	1⅜	1⅜	Ap.1, Ap.15, Q 0.12½
La Rose	Toronto	*48	*45½	*46	Apr., 1922 0.10½
Lorrain Trout Lake	Toronto	1.12	1.10	1.11	Ap. 15, 25 0.05
McKinley-Dar.-Sav.	Toronto	*34½	*33	*34½	Oct., 1920 0.03
Mining Corp. Can.	Toronto	2.70	2.66	2.67	Sept., 1919 0.12½
Nipissing	N. Y. Curb	5¼	4⅞	5⅛	Mh.31, Ap.21 0.15
Ontario Silver	New York			5⅛	Jan., 1919 0.50
Temiskaming	Toronto	*17	*17	*17	Jan., 1920 0.40
SILVER-LEAD					
Ahumada	New York	11⅛	10	11⅛	Mh.16, Ap.2,X 0.25
Bingham Mines	Boston	31⅛	28	30½	Mh.20, Mh.31 0.50
Cardiff M. & M.	Salt Lake	1.15	1.15	1.15	De.16, No.18 0.10
Chief Consol.	Salt Lake	3.60	3.60	3.60	Ap. 10, My. 1 0.10
Columbus Rexall	Salt Lake	*15½	*15½	*15½	Aug., 1923 0.05
Erupcion	Boston Curb	3 3/16	3	3⅛	Mh.16, Ap.2, X 0.20
Federal M. & S.	New York	16½	15⅛	15⅜	Fe.26, Mh.15 Q 1.75
Federal M. & S. pfd.	New York	53½	52½	53⅛	No.25, De.15, 1.75
Florence Silver	Spokane	*1⅞	*1	*1⅛	Apr., 1919, QX 0.01
Hecla Mining	N. Y. Curb	15	14½	14⅞	Fe.15, Mh.15 0.50
Iron Blossom Con.	Salt Lake			*37	Oc.25, 1924 0.01½
Iron King Mining	Salt Lake	*59	*55	*59	
Keystone Mining	Salt Lake	*65	*64	*65	
Mammoth Mining	Salt Lake	2.45	2.15	2.20	My.15 My.25 0.10
Marsh Mines	N. Y. Curb			*4	June, 1921 0.02½
Park City	Salt Lake	4.75	4.75	4.75	Mh.14, Ap.1 0.15
Park Utah	Salt Lake	3.95	3.90	3.92½	April, 1924 0.15
Prince Consol.	Salt Lake	*28	*25	*28	
Silver King Coal	Salt Lake	6.30	6.25	6.25	Mh.20,Ap.1, Q 0.20
Silversmith	Spokane	*23½	*22	*22	Ap.1, Ap.10 0.01
Tamarack-Custer	Spokane	*85	*76	*85	Se. 22, Se. 29 0.25
Tintic Standard	Salt Lake	9.25	9.10	9.25	Mh.23, Mh.30 0.40
Utah-Apex	Boston	6⅜	6⅛	6⅛	Ap.5, Ap.15, 0.35
Western Utah Copper	N. Y. Curb	*14	*14	*14	
IRON					
Bethlehem Steel	New York	41	39½	40	Jn.1, Jy.1, Q 1.25
Char. Iron	Detroit	*20	*20	*20	
Char. Iron pfd.	Detroit			*85	
Colorado Fuel & Iron	New York	39⅞	34½	38⅜	May, 1921 0.75
Gt. North'n Iron Ore	New York	30⅛	29⅜	29⅛	Ap.11, Ap.30 1.00
Inland Steel	New York	40⅛	38⅞	40⅛	My.15, Jn.1 0.62½
Mesabi Iron	N. Y. Curb	2⅞	2⅜	2⅜	
Replogle Steel	New York	16⅛	13½	15⅛	
Republic I. & S.	New York	45⅜	42⅞	43⅞	May, 1921 1.50
Republic I. & S. pfd.	New York			86	Mh.8, Ap.1, Q 1.75
Sloss-Sheffield S. & I.	New York	86⅞	82½	85	Mh.10, Mh.20Q 1.50
Sloss-Shef. S.&I. pfd.	New York			92½	Mh.20, Ap.2, Q 1.75
U. S. Steel	New York	116⅛	114⅜	115	Jn.1, Jn.29, QX 1.75
U. S. Steel pfd.	New York	122½	122⅛	122⅛	My.5, My.29,Q 1.75
Virginia I. C. & C.	New York			35	De.15, Ja.2 1.50
Virginia I.C.&C.pfd.	New York			75	De. 13, Ja. 2, Q 2.50
VANADIUM					
Vanadium Corp.	New York	27⅛	25⅝	27⅛	Jan., 1921 1.00
ASBESTOS					
Asbestos Corp.	Montreal	77⅛	60	74	My.1, My.15 Q 1.00
Asbestos Corp., pfd.	Montreal	107⅛	103	105	Ap. 1, Ap. 15, Q 1.50
SULPHUR					
Freeport Texas	New York	16⅛	11⅞	16⅛	Nov., 1919 1.00
Texas Gulf	New York	109	106¼	106½	Mh.2, Mh.14, 1.75
DIAMONDS					
De Beers Consol	New York			20⅜	Ja.6, Fe.2 0.95
PLATINUM					
So. Am. Gold & P.	N. Y. Curb	2⅜	2⅜	2⅜	
MINING, SMELTING AND REFINING					
Amer. Metal	New York	48⅛	46¼	48⅛	My.19, Jn.1, Q 0.75
Amer. Metal pfd.	New York			113	My.20, Jn.1, Q 1.75
Amer. Sm. & Ref.	New York	95½	93	93⅝	Ap.13, My.1, Q 1.50
Amer.Sm.&Ref.pfd.	New York	108	106⅛	106⅜	My.8, Jn.1 Q 1.75
Consol. M. & S.	Montreal	71	68⅛	71	De.11, Ja.15 SA 0.75
Federated Metals	N Y. Curb			37⅛	
Southwest Metals	N. Y. Curb			*80	
U. S. Sm. R. & M.	New York	34⅜	33⅛	33⅛	Ap.6, Ap.15 0.75
U.S. Sm. R.&M.pfd.	New York	45	44	45	April, 1925 0.87½

* 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.

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.

LONDON QUOTATIONS, WEEK ENDED APRIL 25

	High	Low	Last	Date	Per Cent
Aramayo Mines	77/6	75/—	77/6	May 1925	5
British Platinum	9/4½	8/1½	8/9	Feb. 1925	2½
Bwana M'Kubwa	5/9	5/4½	5/6		
Camp Bird	2/9½	2/—	2/9		
El Oro	6/6	6/3	6/6	Nov. 1924	2½*
Esperanza	1/—	—/10½	1/—		
Frontino & Bolivia	12/—	11/6	11/9	1923–24	10
Mexican Corporation	13/9	12/9	13/6		
Mexico Mines of El Oro	70/—	67/6	70/—	Dec. 1924	25
Nechi (pref. 10s.)	2/6	2/3	2/6	1921–22	25
Oroville Dredging	6/9	6/6	6/9	Dec. 1923	3¾
Ouro Preto	7/9	6/10½	7/6	Oct. 1924	5
St. John del Rey	17/4½	16/7½	17/3	Dec. 1924(a)	3¾
San Francisco Mines	26/6	24/9	26/3	Jan. 1925	20
Santa Gertrudis	10/9	9/7½	10/6	July 1920	5
Selukwe (2s. 6d.)	19/6	17/—	18/3	April 1917	6¾
S. American Copper	9/—	8/—	9/—	Nov. 1917	75
Tanganyika	29/4½	25/—	28/3		
Tomboy	3/9	3/6	3/9	Feb. 1925	4½
Union Miniere du Haut-Katanga (Brussels)	....	....	4.605	July 1924	80(b)

* Free of British Income Tax. (a) Dividend of 6¼ p. c. to be paid June 26, 1925. (b) Belgian francs.