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Diamond Drilling for Carnotite in Colorado

By George Kunkle

Prospecting of this kind requires unusual care, the writer states. An inexperienced man is likely to be misled and "find" ore where there is none. A description of methods that have proved reliable is given as a guide to others who may do similar work.

Recovering the Maximum Quantity of Oil

By S. F. Shaw

As petroleum production in a given field decreases attention turns to methods that promise greater yield. The logical way, the author says, is to use the gas pressure more efficiently, rather than to increase the number of openings in the area.

Annual Meeting of
American Zinc Institute
in St. Louis
Complete Market Report
New Machinery — Discussion

Development and Operation of a 50-Gram Flotation Machine

By John F. Gates and L. K. Jacobsen

Preliminary experiments can be conducted to advantage with this equipment, those responsible for its development think. Simplicity of installation, moderate cost and rapidity are claimed for it. Results, it is said, compare favorably with those obtained with 500 or 1,000-gram machines in testing laboratory work.

Sulphur, Sulphates and Sulphides as Fertilizers

By George Schumacher

Waste by the mining industry annually of large quantities of sulphur in one form or another is a well-known fact. Agricultural experiments made with such material have resulted in greater yields of the crops to which it was applied, indicating a possible market for this byproduct. Data demonstrating this are given.

Possibilities of the Calico Mining District

By F. B. Weeks

High-grade ores were worked forty years ago in this camp, which today is almost forgotten. It lies in the heart of the Mojave Desert in San Bernardino County, Calif. Its principal mineral values have been in silver and borax. Undeveloped gold veins also are reported, as well as surface indications of lead-silver ore-bodies that have never been opened up. The article is conservative.

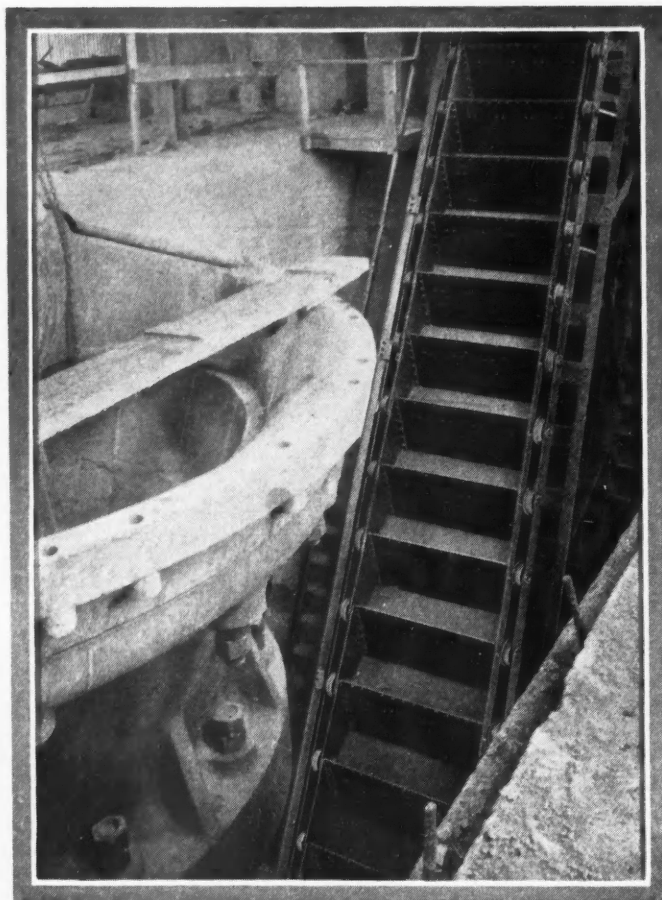
A Study of Temperature in a Two-Stage Air Compressor

By W. S. Weeks, C. F. Milisich and
H. Le C. Berteaux

Explosions in such equipment from time to time draw attention to the possible causes of the heating that has occasioned them. Results of a test made at the University of California to determine these are presented interestingly in this issue.

NEXT WEEK

A New Method of Meridian Determination



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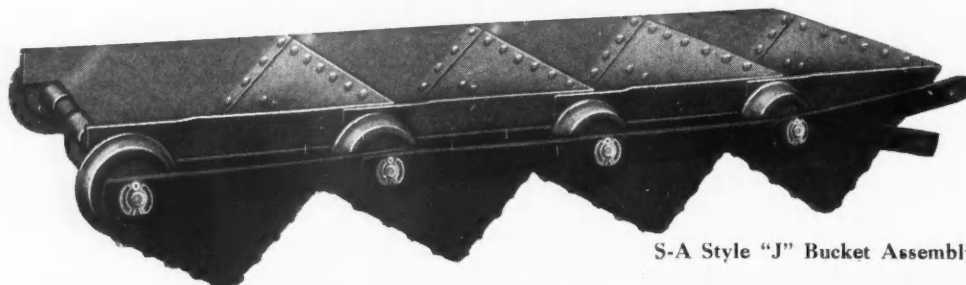
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A New Method of Meridian Determination

IT IS SELDOM that an improvement is made in surveying practice. Methods have been so well standardized that a surveyor in Alaska uses the same principles and instruments as his colleague in Africa. This is particularly true of the methods used to determine the true north and south, and the latitude of the point of observation. Two systems have been popular with engineers in meridian determination—observation on Polaris or observation on the sun. If Polaris is used, the surveyor generally must make his observation at a certain time, calculated in advance, when the star is at elongation—at the most easterly or westerly point in its path around the pole. Of course, the observation may be made at other times, but this involves calculations which the average surveyor is usually anxious to avoid. The other method, observation on the sun, can be made quickly during a long period of each sunny day, but has the drawback that it requires much figuring to give a result, and, if not carefully done, is inaccurate. We doubt very much whether the ordinary surveyor knows enough about the theory of a solar observation to understand the principles and mathematics used, although he may be thoroughly acquainted with the practice needed.

A new method of meridian determination has recently been evolved by Mr. Howard R. Ward, mining engineer, of Wharton, N. J., which is very simple, can be used at nearly any time of night when the stars are visible, and is accurate. We shall publish a description of the Ward method in our next issue. It has been examined and approved by competent engineers, in private and government service, and has been put through test after test to demonstrate its accuracy. Briefly, the method uses two stars near the pole, Polaris and either Alkaid (of the Big Dipper) or ϵ Cassiopeiae. In this respect it is somewhat similar to the method of Bardsley, using two stars, developed at the School of Mines at Rolla, Mo., but it does not require the extended tables of Bardsley's operation. Rather than give a complete description of the procedure here, we shall wait until publication next week, when complete details will be given, together with necessary tables. Mr. Ward's method is certainly time and labor saving and the easiest method of finding a true north and south of which we know.

The Arsenic Situation in the United States

WITH HIGH PRICES FOR ARSENIC in the last two or three years, this formerly despised by-product has become a major product of some mines, and smelters generally have turned from wondering how they could get rid of the stuff to a consideration of how their arsenic recoveries can be increased. In recent months prices have dropped materially, and there is much speculation as to whether this substance is again to be a drug on the market in the same sense

that it was a few years ago. A brief survey of conditions in the United States is therefore of interest.

The production of arsenic in the United States is now only about half what it was this time last year, the peak figure having been 1,819 tons, in April, 1924, when the price was 11@12c. per lb. January, 1925, production was 978 tons, that being the last reported. The production has exceeded consumption for over a year now.

The year 1923 was the big year for arsenic consumption, owing to the prevalence of the boll weevil: close to 25,000 tons was used, of which nearly half was imported. In 1924, the boll weevil was not active, and the demand for arsenic for his suppression fell off greatly, though still about 19,000 tons was sold. In recent months demand has been very poor, though there are possibilities that the boll weevil may be more active this year.

At the end of 1922 arsenic stocks were only 835 tons; at the end of 1923, 1,046 tons; and at the end of January, 1925, 6,997 tons. Stocks have increased for each month during the last year, so producers have cut down their production markedly. With current supplies that are available, producers could easily supply the market with 25,000 tons of arsenic during the current year, and this probably could be increased to 40,000 tons or more, with imports, without the price going above 10c.

Prices for white arsenic have declined from 11c. in April, 1924 (and higher before that), to 5½c. now for high-grade domestic material. There seems little likelihood of a further reduction in price unless the coming season is unexpectedly disappointing. On the other hand, should a good demand set in, with boll weevil activity, the price would be likely to advance somewhat. Most producers are not anxious to have prices go above 10c., and they would probably try to hold them below that level unless the demand should be so great that the market ran away from them. They claim little or no profit at present levels, and are not disposed to cut prices further. Poor grades of imported arsenic are reported sold for less than 5c.

Marketing conditions remain unsatisfactory. Farmers will not buy until they need the insecticide, and insecticide makers will not buy until they can see a market for their product. This leaves the producers of white arsenic holding the bag, and accounts for the continued increase in stocks. The National Chemical Co., of Pittsburg, Calif., controlled by the Sloss financial group in San Francisco, however, has been producing calcium arsenate at capacity for some months, it is reported, and shipping it to warehouses in the South, where it will be ready for distribution when and if it is required. This is the first company that has had sufficient confidence in the demand to do this on any scale. Others seem to feel that the boll weevil may not be active, or that substitutes may be developed.

Violent price fluctuations are extremely unsatisfactory to producer, manufacturer, and consumer; and more stabilization is greatly to be desired.

Business Cycles

BUSINESS CYCLES may be more appropriately termed business waves. These waves have their long rise, their crest, their steeper decline to the trough; and then comes the beginning of a new wave. Much loss and gain of fortune results from this fickleness of affairs; and it has been considered highly desirable, by students of finance and economics, that these waves should be smoothed down, so that a level or calm should come upon the tide of business or industry. Whether such a calming would or would not be beneficial, it is not easy to foresee; adversities have their uses, which are often not recognized until they no longer appear. Nevertheless, nearly everyone would be glad to see the sharp rises and falls, which have brought on in the past recurrent stages of business crises, weakened or obliterated. The stock market and the brokers which serve it would not: their business is with fluctuations, and without these they would seek for other employment. And whoever else purchases for a rise in value would not, for the secular rises in value are not important in comparison with the rises due to fluctuations. To buy low and sell high is the ambition of every business man; and without the business cycles or waves this test of shrewdness and ability would be dwarfed.

The wave or cycle system is not only typical of the sea, but of much else in nature, which is typified by the pendulum. Stability and equilibrium are maintained through the average of exaggerated movements on either side of the norm. Sound, light, and electricity are waves or vibrations: the seasons, the crops—life. It was a rash undertaking for King Canute to oppose himself to the rhythmic rise and fall of the ocean's surface; and it would be a hard task for economists to bind the economic forces which cause major and minor fluctuations in business. The dissemination of knowledge and judgment will, however, soften the asperity of business waves.

The Sufficiency of Natural Resources

CONCERNING the rapid exhaustion of our natural resources, as, for example, gold, Dr. Charles Keys, editor of *The Pan-American Geologist*, takes the position that there is no occasion for viewing with alarm, believing that the increase of production is the result of modern methods of efficiency in the recovery of metals and in operation; and that there is no fear about ore reserves. This is sufficiently hopeful, but, taking flight, he anticipates the fulfillment of the alchemist's dream "that by turning an invisible ray from our sun or from the stars upon our earth, the latter turns to gold now appears within the reach of men now living."

"Our sciences tell us of rays beyond the spectrum; of other rays to which all matter is transparent; of magnetic force too feeble for unaided senses to perceive; of mass particles beyond our ken, crystule, molecule, atom, electron; of worlds of greatness and worlds of littleness. Who then shall doubt but that there may be playing about us in the universe millions of forces absolutely hidden from the human mind. For every one of these most subtle powers we strive for; for every one we reach out and grasp at; for every one we capture and bring under control; we lengthen

out the human years; we broaden immeasurably and give new impetus to the thoughts of men. We lead a full existence, enjoy a larger happiness, and make each lowly life the more worth living."

We believe that Dr. Keyes will qualify as an optimist, and we hope he will live to write our biography, which has long been our secret ambition, for no kindlier or more human pen ever reviewed his contemporaries. Nevertheless, it should be pointed out that in the delicate balance of this work-a-day world's affairs, a sudden superabundance of cheap gold would be far more disquieting and upsetting than a gradually arriving gold famine; for in the former case the abandonment of the gold standard would be seismic in its effects.

On the other hand, Dr. N. M. Fenneman, in his address as vice-president of the American Association for the Advancement of Science, at Washington, in December, took as his subject the apparently drearier outlook: "The outlook for human society is a fully populated world with diminishing resources." He divides natural resources into four classes, of which mineral resources, since they are not replenishable, are the most precarious. Concerning this group, he says:

"The facts about Class D are always disquieting. It is given to every thoughtful man to be shocked at least once when he realizes that some very common and supposedly necessary substances have not long to last. It required a good imagination to visualize life even in the twenty-first century."

Weighing the possibilities of the growth of scientific knowledge and of invention as a palliative, Dr. Fenneman concludes that:

"A stronger case may be made out for the attainment of a maximum rate of advance to be followed by a gradual slowing down; a maximum degree of complexity in our civilization to be followed by returning simplicity. So far as can be seen the use of mechanical energy (now mainly from coal) will follow such a course. The use of all metals will follow the same course, the cost of iron in a few centuries becoming similar to that of copper or lead today. It would seem that an increasing portion of human life must be given to the wresting of food from a limited soil for a greatly increased population. What with the low cost of human beings and the high cost of machinery, it would not be surprising to see much machine work revert to simpler methods.

"Increased efficiency in labor, in machinery, and in organization, would retard rather than prevent the changes which are here forecast. Revolutionary discoveries may be made, but for the present these are speculative factors and do not enter into the calculation."

A similar view to that of Dr. Fenneman has been presented by Dr. F. W. Tryon, of the U. S. Geological Survey, in a paper presented before the American Statistical Association in Washington last December. Acknowledging the social disadvantages of the rôle of Cassandra, Dr. Tryon has analyzed the sufficiency of natural resources for an expanding population and its industry; and, rightly considering power as the central element in industry and mechanical civilization, considers the question of the reserve supplies of coal and oil and water-power, the prime sources of energy. The resources of water-power are far more definitely limited than is commonly realized; so that coal and oil will

continue to form the backbone of our modern methods of life. Dr. Tryon sees a constantly increasing cost for power, which means a constantly increasing amount of human labor necessary for a unit of production, a conclusion to which Dr. Fenneman has also come. This means progressively harder work or simpler living—probably the latter; and many more complex consequences.

It is indeed inevitable that results like those visualized by Dr. Fenneman and Dr. Tryon should gradually come to pass. Great as has been our scientific advance, it has all rested upon the foundation of natural raw materials, for which we have found no adequate substitute. Take these away, and all the paraphernalia and pomp of present-day civilization disappears. But there still remains, as has been pointed out, the possibilities of civilizations like those of Greece, which in the midst of simplicity of life developed great intellectual and moral power. But even this type of civilization is incompatible with over-population, which brings mental and spiritual stagnation, as exhibited in India and China.

Bureau of Mines Transfer

IT IS REPORTED from Washington that the transfer of the Bureau of Mines to the Department of Commerce is imminent, and that, except for some technical difficulties, it would have already been accomplished. The chief drawback would be the separation of the Bureau of Mines and the Geological Survey into different Departments, and thereby a weakening of that inadequate federal executive representation that the mining industries have obtained. The general comment is that if Mr. Hoover was Secretary of Commerce for life, then well and good; but, since he will not be, the move would be one of doubtful advantage. Mr. Hoover, on the other hand, rightly regards mining as an industry: and the transfer to the Department of Commerce would allow a development of the economic and business side of mining, which it has been found impossible to handle in the Interior Department.

It is to be hoped that the Bureau of Mines and the Geological Survey will not be put into different Departments. Let Mr. Hoover take over both or neither; if he would take over both, objections would probably be withdrawn. Even if many Secretaries of Commerce (before Mr. Hoover) have not been notable for strength, it is also true that many Secretaries of the Interior have been remarkable for their ignorance of the mining industries. And the Department of the Interior is more or less of a junk shop, which embraces many uncorrelated bureaus and activities.

Proper rearrangement of government bureaus and departments would doubtless be beneficial; but the study given to the subject by the governmental committee appears to have been somewhat superficial.

Elections in Germany

THE GERMAN ELECTIONS last week undoubtedly were discouraging to well-wishers of Germany and of the world. They were, however, not unnatural. Nations move not in a steady line, but in swings back and forth; and proceed by the method of trial and error. Vacillations between monarchies and

republics characterized Greece, Rome, and France. People bred to obedience, discipline, and the love of authority, like the Germans, cannot immediately feel at home in a more individualistic society. The frame of mind shown by the results of the election will encourage the stiffening of nationalism in other countries, especially in France; and there is no doubt that this concentrated nationalism is a menace. In the long run, the incident may mean little. Washington seems desirous of interpreting the gesture as one against socialistic experiments rather than a militaristic one. Nevertheless, it was a characteristic German blunder; and while in pre-war days German blunders were taken good-humoredly, and without attributing any importance to them, this optimistic attitude of the outside world can never return.

Living and Operating Expenses in Mexico

THE LATIN-AMERICAN DIVISION of the Department of Commerce has sent out a circular with the above title. The conclusion stated is that living costs in Mexico City are now considered as being 50 to 75 per cent higher than in representative cities of the United States. Cost of standard foods as compiled by the Mexican Government is 62 per cent higher than in 1914. Rents and clothing have shown a still greater increase.

"It has been the experience of many Americans who have gone to Mexico to open agencies or representations for their houses that the allowances given them have been insufficient, and in some cases totally inadequate."

The American Chamber of Commerce in Mexico City has compiled figures on the average cost of living of American families there; and from these and from other available figures the Latin-American Division of the Department of Commerce estimates that the cost for a family of four is about \$5,800 per annum. The average budget for the American family, published by the American Chamber of Commerce in Mexico City, was given at \$6,888 in 1923. A general questionnaire as to the minimum salary for an American, sent out by the above-mentioned Chamber, resulted in an average of about \$3,900 for a single man and \$6,200 for a man with a wife and two children. Clothing is stated to be 25 or 30 per cent higher than in the United States.

"In general," the report concludes, "it may be said that with reasonably comfortable quarters, and barring undue illness or other misfortune, the cost of living for a representative American family in Mexico City will not run below \$500 a month."

We give the above estimate for what it is worth. Some of the substantiating items are not entirely convincing; for example, where the circular says: "Incidental necessities are more expensive in Mexico than in corresponding cities in the United States. For example, a family of four averages about \$10 per month for electric current, because of the necessity for using electric heaters." Moreover, it will be remembered that these estimates apply to Mexico City and cannot be assumed to pertain faithfully to the conditions which surround positions in the mining camps. It would be interesting to receive data from some of our mining friends in Mexico, as to the relative cost of living in such camps compared with the cost in representative mining camps of the United States.

Great Britain's Return to the Gold Standard

By Robert Murray Haig, Ph.D.

Professor, School of Business, Columbia University

IN 1874 Professor William G. Sumner wrote "England is the only country which after falling into the use of inconvertible depreciated paper, has returned to specie payments save through bankruptcy." He was referring to the restoration of the gold standard after the Napoleonic wars. Since he wrote, several countries have accomplished this feat, our own resumption of specie payments in 1879 being one notable case. But it was England who did it first.

With such a tradition, England's ultimate return to the gold standard was a foregone conclusion. Some arguments have been recently advanced, it is true, in favor of a permanent "managed" currency, but have won few adherents. The complaint of the opposition in the House of Commons is directed not to the wisdom of the policy but merely to the "undue precipitancy" with which it is proposed to carry it out.

The decision to resume specie payments at this precise time was influenced by several factors. The act of 1920 prohibiting the export of precious metals except under license was due to expire at the end of 1925. An extension of the expiration date might have been construed as a confession that the financial position was disappointingly weak. Again, if the change to the gold basis were to be made during 1925, the spring was a more favorable period than the fall. Finally, the financial leaders of England desired greatly that the re-establishment of the gold standard be accomplished under the direction of Montagu Norman, who has for some time been eager to retire from his post as Governor of the Bank of England. Consequently, it was determined not merely to allow the Gold and Silver Export Control Act of 1920 to lapse on Dec. 31, but to move to the gold basis at once by giving to the Bank of England a general license for the export of gold and bullion from the date of the budget speech.

Churchill's announcement meant that hereafter, with certain minor restrictions, any one who chose to do so might present legal tender at the Bank of England and receive gold in exchange at the price of £3.17.10½, per standard ounce, the old traditional mint price. In other words, the British pound is now exchangeable for \$4.86 worth of gold. The immediate effect is that those who possess bills payable in pounds will not part with them for less than \$4.86 per pound, minus the actual cost of obtaining gold from the Bank of England and bringing it to this country. This cost is slight, one English firm estimating the "gold point" (the price below which the quotations for bills will not go, because the owners will withdraw the gold and ship it under present conditions) at \$4.848. In other words, a pound owned by an American business man is now an item which is worth practically \$4.86 and will continue to be worth that amount, whereas a year ago this time it was worth only \$4.38, and might be worth less at any moment. During

1924 the worth fluctuated between \$4.21 and \$4.73. In February, 1920, it reached \$3.20, its lowest point.

In the future, then, the pound will fluctuate only within very narrow limits. It will be affected merely by the variations in the supply and the demand for foreign exchange, whereas in recent years it has been affected not only by such variations but also by the variations in the depreciation of the British inconvertible paper money. Thus passes an element of great uncertainty. International trade can now be conducted with greater confidence. Business will be less a gamble than it has been for a decade past.

The less immediate but yet very important effects relate to the price England must pay to re-establish its gold standard. One factor relates to the actual depreciation of the British paper money. Has it been issued in such quantities that its value is far below gold? Will it be presented for redemption in such quantities that the government will be required to obtain large supplies of gold to meet the demand?

The paper money outstanding is of two kinds: Notes of the Bank of England, which are backed substantially pound for pound with gold, and the currency notes or "Bradbury's," issued during the war, against which the Treasury holds a relatively small reserve of £27,000,000 in gold. Churchill announced that there had been accumulated a total gold reserve of £153,000,000, which apparently means that the gold stock of England amounts to nearly 40 per cent of all the paper money in circulation.

Resting on the assurances of his committee of experts, Churchill counts on a volume of exports, visible and invisible, together with the income derived from foreign investments, sufficient to meet England's foreign debts and pay for all necessary imports and even to supply a moderate balance for new foreign investment. However, as a measure of caution, arrangements have been made in New York for credits amounting to \$300,000,000, to be used "if, as and when they are required" to support the foreign exchange market. It is understood that these credits may be expanded "if need be." Sufficient American exchange has also been accumulated so that the government need not enter the market this year to secure funds to make its payment on its debt to the United States.

Only experience will show whether it will be necessary further to contract the currency to maintain the gold standard. It has already been substantially reduced. Apparently it is the intention to fix "the ultimate limits of fiduciary issue" at an amount which can be carried on a reserve of approximately £150,000,000. During the resumption of specie payments after the Napoleonic wars, there was a very substantial contraction of the currency, the Bank of England retaining its notes as they came back, and the country

banks also being forced to do the same. On the other hand, when the United States moved to the gold basis in 1879, there was no contraction at all in the paper currency, and the operation was carried through by Secretary Sherman on a fund of gold which amounted to less than 40 per cent of the greenbacks outstanding. What will occur will depend largely upon whether business continues buoyant or depressed.

The evidence of the price indices would indicate that the depreciation in the British currency had already practically disappeared. The April number of the "Monthly Review" of the Federal Reserve Bank of New York shows that for twenty basic commodities prices were lower in England than here.

So far, then, as may be judged from the data available, there seem to be slight grounds for the fears of the leaders of the Labor Party lest the immediate restoration of the gold standard aggravate the existing grave conditions of unemployment and trade depression.

The costs to be met by England are the hardships which may ensue should it prove necessary further to deflate the currency and the expenses of the measures which may be required to support the foreign exchange market. The expenses of the American credit to support credit are problematical. London financiers believe that it will probably be unnecessary to use this resource at all. For some time to come England will be eager to attract gold. The rediscount rate of the Bank of England will doubtless be left at a point considerably above our own, which will involve the disadvantage to the British business man of a relatively high money rate. Prices must be left on a basis which will encourage purchases by foreigners. In general, England will for some time probably be found a relatively good place to buy and will be temporarily a relatively bad place to sell. The ultimate effect upon the interests of both those who would buy and sell there will likely be favorable.

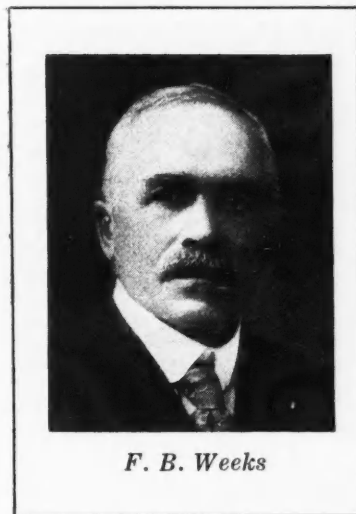
England's action should, moreover, stimulate other countries toward currency stability. Americans will take special interest in France's action. Few students believe that France can meet the costs involved in returning to specie payments on the basis of the old par value of the franc. France failed to balance her 1924 budget by 11 per cent. Her currency continues to expand. The franc sells at about 5.24 (par 19.3), lower than a year ago. The situation has drifted to a point where to re-establish the old value of the franc, granted it were financially and politically possible, would involve intolerable injustices as between debtor and creditor classes. After all, internal stability of prices is relatively more important and the re-establishment of exchange on the old par relatively less important in France than in England. It would be well for France to move to a gold basis, but that basis should undoubtedly be much nearer the market value than the face value of the franc.

Possibilities of the Calico Mining District

A Description of an Almost Forgotten Camp in California That Was Worked for Its High-grade Ores Forty Years Ago

By F. B. Weeks

Mining Engineer and Geologist, Daggett, Calif.



F. B. Weeks

ONE of the unusual anomalies of mining development and history is that a district having added thirty or more millions of wealth to a principal mining state, situated within four to six miles of two trans-continental railways and two auto highways, and within 150 miles of the most widely advertised part of the United States, should have been so completely lost sight of that probably not one

mining man in ten can tell offhand where it is situated. Such is the Calico mining district, in California.

The district was developed from the profits derived from its high-grade ores, and no large company or well-known mining men took part in its development. Stocks of the companies were never widely distributed or generally traded in on any large stock exchange. Hence it is not strange that, with the average yearly price of silver declining from \$1.13 in 1882 to 63c. in 1894, and lowering of grade of ore to the point where extraction was unprofitable under the conditions of the market and of mining and ore handling that prevailed, mining operations in the district eventually ceased and operators and miners dispersed to more promising fields.

A DESERT LOCATION

The Calico district lies 150 miles northeast of Los Angeles, in San Bernardino County, Calif., in the very heart of the so-called Mojave Desert. The mines are 6 miles north of Daggett on the Santa Fé Ry. and 4 miles northwest of Yermo on the Union Pacific Ry. The greater part of the mining district lies along the middle and lower slopes of a northwesterly trending range of mountains to which the name Calico has been given, because of the great variety of colors of the rocks exposed, which at times appear quite brilliant in the varying light effects of clouds and bright sunshine. The principal economic values of the district have been in silver and borax, though there are undeveloped gold veins near the principal silver veins, and the extension of the district to the northwest affords surface indications of lead-silver orebodies as yet undeveloped.

The extent of the mineralized area is 2 by 5 miles, though the principal development has been confined to an area 2 by 2½ miles. The elevation of the railroads is 2,000 ft.; that of the mines varies from 2,400 to 3,000 ft., and the highest peak of the range is about 5,000 ft. above sea level.

The mountain slopes are generally steep and occasionally precipitous. Drainage lines have low gradients about their heads, but they frequently form "box canyons" for half a mile above the fan-shaped deposits or "wash" formed of the eroded materials brought down from the higher summits by torrential rains of former times and which even now at rare intervals sweep across the country.

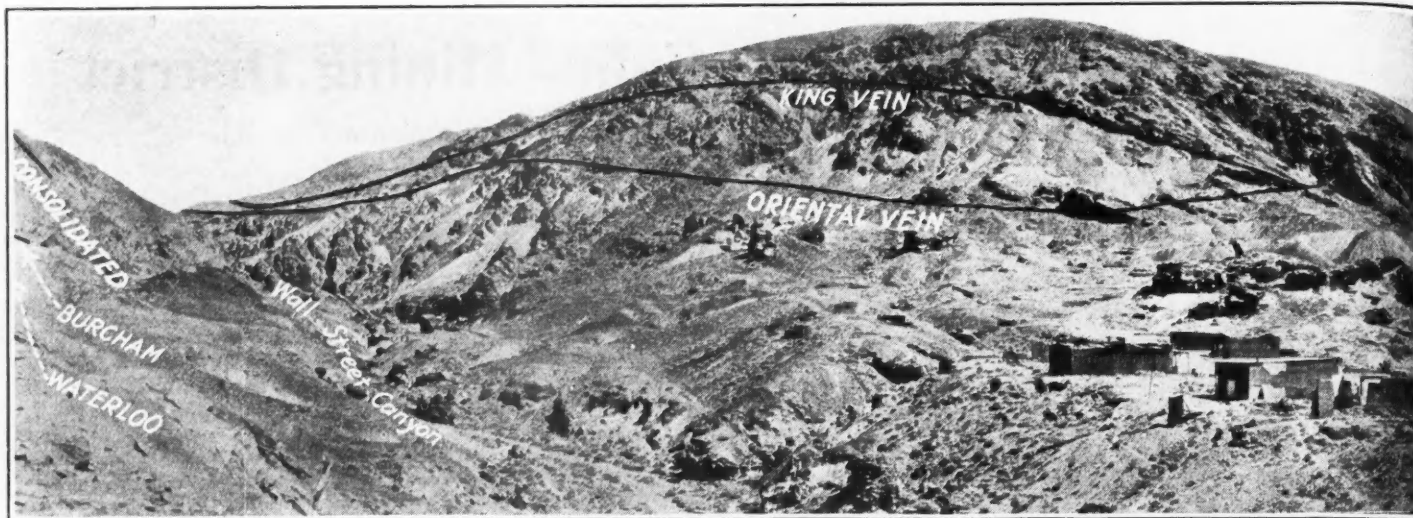
Wall Street Canyon and Odessa Canyon each forms a "box canyon," half a mile long, 300 to 400 ft. in height, and only 20 to 100 ft. wide. The walls are precipitous, sometimes perpendicular for 200 ft., above which they break away into huge spires and pinnacles, brilliant in the noonday sun and dark and gloomy as the shadows deepen with the disappearance of the sun from their depths. These canyons are unique in their variety of sculptured forms and unusual coloring.

Precipitation averages about three inches annually. This may fall within a few hours, and a whole year may pass without rain. Snow very rarely falls, and when it does it disappears within a few hours. The winters are a continuous succession of delightful sunny days, with an occasional light frost, and the summer days from June 1 to Oct. 1 have daily maximum temperatures of 100 to 110 deg. The temperatures at the elevation of the mines is 5 to 10 deg. less.

WATER SUPPLY SCANT

Water for domestic, mining, and milling uses is derived wholly from wells. These wells are located along the foot of the mountain slope below the mines or along and near the bed of the Mojave River, which heads in the high summits of the San Bernardino Mountains. Below Victorville its water disappears in the river-bed gravels, but comes to the surface at several points where the bedrock rises. Below Barstow the river bed is dry except in periods of extreme floods from rain and melting snow about its headwaters. At such times the river bed becomes a raging torrent that carries everything with it, cutting away its banks, and here and there changing its course, and finally debouches from Afton Canyon upon a broad desert valley south of the station of Silver Lake, on the Tonopah & Tidewater Ry., where at flood times it forms a shallow lake several miles in extent from which it in time evaporates. This underground water supply is no doubt in part maintained by sinking of a part of the flood waters into the river-bed gravels and in part by surface and under-surface flow from an area of many square miles lying to the north of the Barstow and Calico ranges, which drains into the valley that lies along the southwest side of the mountains below the mines.

The question at once arises whether a water supply from these sources will be maintained in sufficient quantity to be adequate for extensive milling operations. During the time of greatest mining activity seven mills were in operation, dropping a total of 135 stamps. One



Panorama of the Calico mining district of California, showing the principal

well supplied 300,000 gal. of water daily to a 30-stamp mill, and one-eighth of a mile distant was another well that supplied the town of Calico, with a maximum population of 3,000. Another well near the Mojave River supplied 65 stamps. These and other wells are not now in use, but would require only a little work to make them serviceable. The water appears to have a common level, the depth being 50 to 150 ft. depending on the topography of the surface.

No water has been encountered in any of the mines. Should the water level of the nearest wells prove to be the water level in the mines, 200 to 300 ft. of sinking below the deepest mine workings would be required to reach it.

All the mills above referred to have been razed, and nothing remains but the tailings. These tailings are said to contain in certain parts 2 to 3 oz. silver, and in others as much as 5 or 6 oz. Recent attempts to work them have proved unprofitable.

HISTORY OF THE DISTRICT BEGINS IN 1879

Mining operations began about 1882 and continued until the early 90's, when company operations ceased. There followed a dwindling production by leasers, so that for the last twenty-five years the district can be said to have had no metallic production.

The first mining claim was located in West Calico in 1879. In 1881 prospectors discovered high-grade ore along the north side of Wall Street Canyon (King and Oriental veins), and on the higher portion of the mountain about half a mile north (Old Oriental and Bismarck veins), in what is known as East Calico, and subsequent mining operations were confined to those vein systems.

The active period of mining extended from 1883 to about 1895. There was a slight revival of mining about 1916, but this was of short duration, and the mills that were still standing, together with mine equipment, were sold for scrap at about that time.

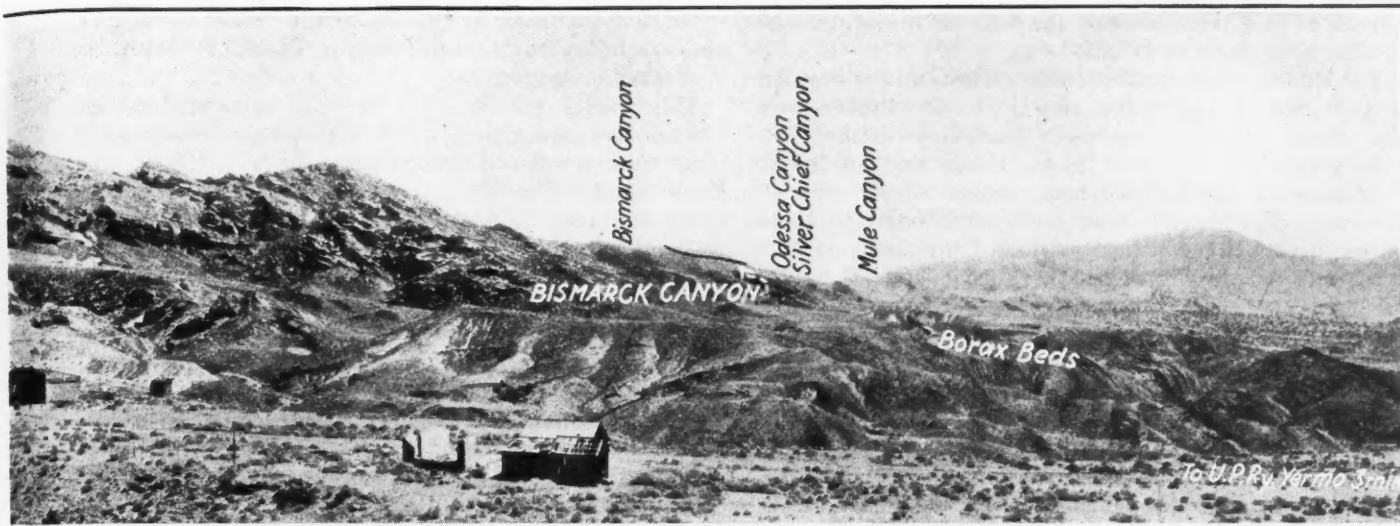
In 1920 development was begun on the Silver Bow vein, and since that time several cars of 100-oz. silver ore have been shipped. About the same time exploration was begun on the Spar and Summit groups, each developing ore carrying 10 to 12 oz. silver, with some ore of higher grade. In 1924 development of one of the lead-silver veins on the Silver Bow Extension claim

was begun and is still continuing. The above-mentioned properties are all in the West Calico section.

The mineralized area of the Calico district is included in Township 1 North, Range 1 East, San Bernardino Meridian. The map shows the patented claims and those held by location as they stand at this time. There are a few other claims whose boundaries were not known when the map was compiled. About 1910 the greater part of the township was resurveyed by the U. S. Government, and the section and quarter corners were marked by iron posts with brass caps, on which is given the section, township, and range. This township is included in the Southern Pacific land grant, but, with the exception of the north half of Section 5, no part of the mineralized area is held by that company. The principal veins are shown by their local names, and sufficient work has been done to establish their continuity as indicated on the map.

No rocks older than Tertiary have been found in the Calico Mountains. A few miles to the southwest, in the low range which lies north of Barstow, is a considerable area of probable Pre-Cambrian schists, and on the lower slopes about 3 miles northeast of Barstow there occur quartzites and yellow and brown, siliceous, highly metamorphosed limestones of probable Cambrian age. Also, in the same range about 4 miles northwest of Barstow there is a considerable area of light-colored, slightly metamorphosed limestones that may represent a period somewhat later than the Cambrian.

A remarkable difference exists in the geological history of the Great Basin region, which lies to the north of a general east-west line extending from the southern end of the Sierra Nevada to the southern end of the Kingston range and the irregular desert ranges to the south. There appears to be no conclusive evidence of a great uplift or subsidence setting off the one region from the other, yet to the north of this line lies the great sedimentary basin of Nevada, extending to the west into central California, to the north far into the Arctic region, to the east to the Great Plains; and, swinging to the southeast, including much of Arizona, New Mexico, and Texas, where the basin is buried beneath the Gulf Coastal deposits, there are many thousand feet of sediments representing every geologic period from the Cambrian to the Tertiary, while to the south of this line no sediments are known to have



Principal outcrops, the nature of the topography and the remains of the old mining settlement

been laid down during a long geologic period. It is difficult to conceive that during this time, extending from the Cambrian to the Middle Tertiary, no sedimentary deposits were laid down in this part of California, and yet it is hardly possible that such deposits could exist and not now be known. If deposited, they have been entirely removed, leaving only remnants here and there of the Cambrian sediments.

It has been recognized for some time that an east-west fault coincides, as far as it has been traced, with the line just mentioned, but the amount of displacement and the direction of throw are undetermined. This fault (the Barlock fault) marks the southern limit of the Sierra Nevada, El Paso, Panamint, and Funeral ranges. How much farther it extends to the east is not known.

The Cambrian quartzites and limestones near Barstow are 2,000 ft. above sea level; the lowest elevation of similar strata, north of the Garlock fault, is in Owens Valley, south of Big Pine, at an elevation of about 4,000 ft. The latter beds, however, lie on the west side of the Owens Valley trough, which appears to be a north-south fault line paralleling the Sierra Nevada, and they are 2,000 ft. or more below the Cambrian limestones in the White Mountains on the east, with which they may have been directly connected before this displacement occurred. The Garlock fault may, therefore, be a major fault, with a downthrow on the south side of 4,000 ft. or more. This still leaves the question as to what happened south of the fault between the Cambrian and the Tertiary unanswered, and it is one of the striking geologic features of this part of California of which the Calico district forms a part. A satisfactory explanation must await the acquisition of more complete data than are at present available.

Differences in the economic history of the two regions have been equally remarkable. The great sedimentary basin to the north has been invaded in many places by intrusions from which have been derived ore deposits that have made this the great economic province of the world, whereas to the south no similar intrusions or deposits are known. The meager ore deposits in the Cambrian and Pre-Cambrian rocks are evidently of Tertiary origin, for the vein fillings are essentially like those of known Tertiary formation.

The desert region was, however, profoundly affected by the great Tertiary revolution that extended from the Arctic to the Antarctic along the western side of the continent. Throughout this entire area intrusive and extrusive materials were poured out, from which have been derived ore deposits that are definitely known to be of Tertiary age, and the Calico mining district and its ore deposits comprise one of the many areas whose orebodies have been formed by these agencies.

BORAX BEDS OLDEST STRATA EXPOSED

The Tertiary (Miocene) borax-bearing beds are the oldest strata exposed in the Calico district. An exposure of these beds lying directly on the Cambrian limestones or quartzites, or Pre-Cambrian schists, has not been found. Northeast of Barstow they are separated by about a mile, which is occupied by surface wash and Tertiary flows. The borax beds are 2,000 to 3,000 ft. thick, and are made up of clay shales, soft sandstones, and thin-bedded limestones, intruded by rhyolite and andesite and in part covered by mud flows that represent the most recent volcanic activity.

These borax beds are correlated with the Esmeralda formation of King, in Nevada, and in this section appear to be of marine origin and probably laid down in a partly inclosed basin or arm of the ocean. They are, for the most part, beach and off-shore deposits in shallow water, as they show well-defined ripple marks on the sandstones and mud cracks in the shales. The strike of these beds is east-west and the dip is to the south, but both strike and dip have been modified locally, in the Calico district, so that the beds are now sharply folded, or stand at a high angle of dip, vertical, or even thrust over to a northerly dip, due to the intrusion and upthrust of later volcanic materials.

The borax beds outcrop along and near the foot of the mountains, and in the photograph may be seen crossing Wall Street Canyon below the town of Calico and extending to Mule Canyon, where they are split apart by an intrusion, one part extending up Mule Canyon and across the divide to the mining camp of Borate, and the other along the middle portion of the high mountain that lies to the north of Yermo. Along the north side of the range, in sections 5 and 6, the borax beds appear in a much disturbed condition, and these represent the beds which have been separated by the

intrusions and breccias from the beds on the south side of the range just described.

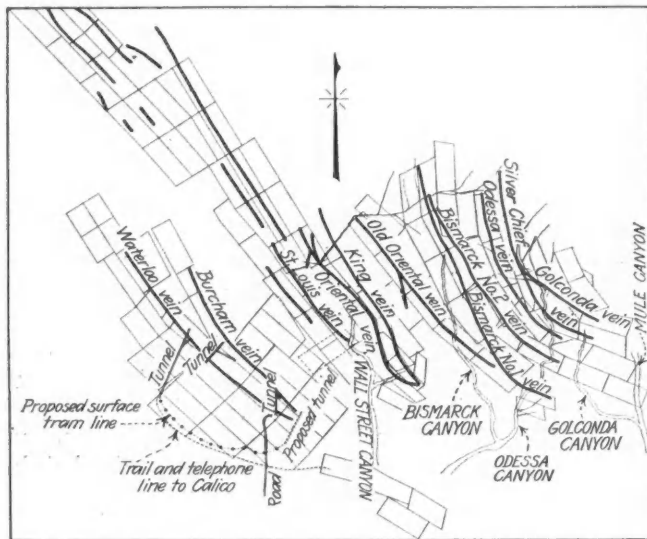
The Calico range is of volcanic origin and is formed of tuff, breccia, intrusive andesite, and rhyolite and later flows. It has a roughly domical structure, the flows generally dipping to the northeast and southwest paralleling in strike the general northwesterly zone of intrusion, along which later movements have, to some extent, locally changed the position of the flows. There appears to have been at least three periods of intrusion, namely:

1. Represented by andesitic breccia with a much smaller amount of massive andesite. This extends from the Young Waterman claim to the Silver Contact No. 2 claim, beyond which it is covered by later rhyolitic flows.

2. Represented by the massive andesite and andesitic flows and breccias which includes most of the area between the King and Golconda veins.

3. Represented by a rhyolite intrusion which occupies the area between the Waterloo and Consolidated veins and extends along the southwest slope of the mountains for several miles.

There are other more recent flows whose relations



Claim map of the Calico mining district, indicating the position of the main veins

have not been determined, except that they are more recent than the intrusions above mentioned. For the most part they lie between Odessa and Mule canyons, and, so far as known, are outside the mineralized area. One of the most striking of these flows is a dark-colored mud flow in which is imbedded blocks of a basic granite up to three feet in diameter. This occurs on the Union and Union West claims and extends across the ridge to the Consolidated claim.

Volcanic activity, in the beginning, consisted in the pouring out of chocolate-colored mud flows, in beds 6 to 8 ft. thick, followed by breccia flows. Interbedded with the mud flows are conglomerates, of which a prominent stratum 4 ft. thick occurs about 50 ft. below the contact of the mud flows with the breccia. The mud beds and flows dip slightly to the southwest and are practically undisturbed except where cut by later andesite and rhyolite dikes. These beds and flows are 600 to 800 ft. thick and occur over a considerable area in West Calico, being largely covered by later

rhyolite flows to the northwest of the two Stella claims, and extending to the southeast to the Sioux claim, in Wall Street Canyon.

This initial volcanic activity was succeeded by an intrusion of andesitic breccia, with which is associated some massive andesite, which extends from the "Lower Falls" of Wall Street Canyon near the northwest corner of the Red Cloud claim, following the southwest side of the canyon, to the "Upper Falls," at the southeast end of the Sioux claim, and continues in a northwesterly direction for about one mile, where it passes beneath an overlying rhyolite flow. On the whole, it is a fine breccia, though in places the massive andesite grades into a very coarse breccia. It is everywhere cut by innumerable veinlets of quartz, calcite, and barite, and also by fissures, which on the Sioux claim have yielded some of the highest-grade ore of the district.

In the lower part of the Wall Street Canyon, near the Oregon claim and extending to the east, is a considerable intrusion of fine, white to gray tuff that is probably related to this intrusion. Some erratic ore masses have been found in this tuff.

The second period of intrusion, which may eventually be found to be contemporaneous with the first, is represented by massive andesite, extending from the King vein to a short distance beyond the Old Oriental vein, where it merges into andesite flows and breccias. The andesite is a dense, hard rock, with large, generally decomposed feldspars, though in some small dikes the rock is finer grained and the feldspars are less prominent. Locally the andesite is called "blue porphyry," from its brilliant color on fresh fracture. Quartz and orthoclase and plagioclase feldspars in a fine felsitic groundmass are characteristic of considerable parts of this intrusion, and the rock would then be more properly called a dacite, but in the field the line of demarcation between what would be called andesite or dacite is not sufficiently defined to permit satisfactory separation.

The third period of intrusion is represented by rhyolite and rhyolite breccia which extends from a short distance west of Wall Street Canyon along the southwest side of the range, from the northwest corner of Section 22 through parts of sections 21, 16, 17, 8 and 7, and the southwest corner of Section 6. The borax beds have been intensely folded and overthrust by this intrusion. A considerable variety of rocks are included in this intrusion, ranging from rhyolite through coarse and fine breccias to a gritty, structureless mass of siliceous composition. In the northeast corner of Section 22 the rhyolite on the surface is vesicular and scoriaceous, and in places resembles an iron-stained slag. In Section 17 the intrusive rhyolite can be seen clearly cutting off the mud beds of the earliest volcanic activity previously mentioned.

Along the northeastern side of the mineralized area is another rhyolitic intrusion which may belong to the same period as the one just mentioned. It lies next to the andesite breccia on the northeast, and remnants of it form a thin capping over the adjoining breccia. The only known ore-bearing vein in it is the Golconda. The rock is a fine, structureless flow, and the vent out of which it flowed appears to be what has been mapped as the Golconda vein. To the north and east it passes under other and more recent flows, which make up the higher parts of the range and are outside the mineralized part of the district.

No tufa deposits or evidences of mineralization by surface deposition from mineral springs that would have been the expression of expiring volcanic activity have been found.

The fissures cut all the flows, breccias, and other rocks of the district. The sedimentary rocks (borax beds), for the most part, lie outside the ore-bearing section. However, the Waterloo and Burcham fissures cut these beds for considerable distances and have proved to be ore bearing. Here the fissures are entirely within the sediments, though the intrusive is always within a few hundred feet of them.

Faulting, with no considerable displacement, has occurred within the district, but whether the orebodies are confined to such faults, or generally occur in fissures unrelated to the faulting, has not been determined. Certain orebodies are known to have occurred in fault fissures, but in general the ore-bearing fissures seem to occur independent of the faulting. Geologic mapping of the surface and underground workings must first be done before the facts can be definitely determined.

The veins of the Calico district exhibit the characteristics of the usual fissure vein—namely an inclined, generally smooth wall, with striations and grooving, indicative of movement along this plane, and gouge, being the finely broken and comminuted material of the adjacent rocks by the movement along this plane; and beyond lies either barren country rock or the ore and gangue intimately mixed where the ore is massive, or distinctly segregated where the ore occurs in bands.

Locally, the fissures change in pitch and strike and split into other fissures, as is characteristic of them in Tertiary rocks, but that they are continuous for 2,500 ft. is proved by mining operations, and outcrops from which ore has been mined at irregular intervals indicate that they are persistent for 6,000 ft. or more. Nothing is known as to the continuation of fissures and veins in depth, as the deepest workings are only 400 ft. below the outcrops, though at this depth their characteristics persist.

One of the unusual and striking features is the occurrence of the fissures and veins in pairs having approximately the same strike and pitch. The Waterloo includes two veins separated by about 50 ft. The Burcham includes two veins, of which the south vein has had but little development. The King and Oriental veins comprise one vein system connected by several cross-veins that have been ore bearing. The Bismarck vein comprises two veins separated by about 200 ft.

In West Calico some of the principal veins or lodes are sheeted zones in which numerous closely spaced planes of movement are mineralized. One of these sheeted zones is 30 to 50 ft. wide, and is known to persist to a depth of over 200 ft.

In general, exploration of fissure veins has shown that they contain little ore and gangue, or none at all (barren), for a considerable part of their extent; but in certain other and smaller portions the ore and gangue have a much greater but varying width, and continuity in length and depth, and these form the so-called oreshoots which constitute the only considerable minable part of the vein filling. There are, of course, notable exceptions to the usual type of fissure and filling, but they are due to local conditions that do not exist where the common type of oreshoot is found.

Mining work has shown that oreshoots in fissure veins have fairly definite boundaries, and outside of them

there is little minable ore. Studies have been made of the structure and composition of oreshoots, but the larger and more important economic problem for the future relates to the determination of the criteria indicated by surface or underground conditions as to where an oreshoot in a vein may be expected. These criteria may be found by a study of the changes in the character and composition of the vein filling as an oreshoot is approached, or in cross-fracturing or fissuring in the rocks prior to the formation of the vein fissure, or other changes that such studies may suggest. Cross-fracturing prior to vein formation has sometimes been found to be the locus of an oreshoot. A prominent example is the Gold Road vein, near Oatman, Ariz., where two systems of cross-fractures, one to the northeast and the other to the northwest, were cut by an east-west fissure vein. The northeast system contained the more widely spaced fractures, on which several inches of soft gouge had developed, and where cut by the fissure vein little or no ore was found. In the northwest system the fractures were closely spaced, with clean-cut, quartz-filled stringers, and here the ore widened out, forming stopes 12 ft. or more in width, the length of the larger oreshoots being coincident with the extent of this system of cross-fractures.

In considering the problem as to how fissure veins are formed, shall we conceive of them as vein or ore dikes consolidated from viscous or gel-like material, acting as other dikes of much greater mass do by splitting apart the intruded rock mass and, by some force inherent in itself, impelled onward and upward, forming the wall and accompanying gouge as it proceeds, while here and there it widens out into definite bodies of considerable extent, paralleling the gouge but lying at some angle different from the inclination of the fissure which it is forming, though for the most part the filling along the fissure is small in amount or non-existent, while the wall and gouge still persist? Or, shall we say that this wall and gouge are the result of yielding to a force from some other source by which the rock mass is broken along a definite plane and by still further expenditure of this force and readjustment, when it is removed, there are developed striations, grooving, and gouge and fracturing in the adjoining rock transverse to the wall; and that by recurrence of this force the fractures and fissures formed by the major movement are filled with gaseous or liquid solutions, or both, along zones of greatest fracturing and least resistance, which, at the horizon where heat and pressure are sufficiently reduced, begin to precipitate or react chemically upon the adjacent rock, and this continues until the whole is precipitated, and as a result we have the bodies or shoots of ore, with long stretches on the fissure with little or no filling? Whether the fissure and filling in this irregular manner is a continuous, progressive development constituting the so-called vein or ore dike, or whether they are separate phenomena closely associated in time, is a problem that can only be definitely settled by far more detailed study of chemical and physical conditions than as yet has been accomplished.

It would appear that the magma from which the Calico rocks and ores were derived was distinctly of intermediate composition. Both the intrusive and flow rocks indicate that the magma did not contain a sufficient content of silica, so that there was a surplus left over, from which extensive quartz veins could be

formed. None of the veins of the district have bold, siliceous outcrops. They are not wanting in silica, but it occurs in banded, not massive, form, and erosion has carried away the disintegrated material of the vein quite as rapidly as that of the country rock. Barite is the predominating gangue mineral, and this is true whether the vein filling is barren or pay ore. However, within the shallow depth to which mining has extended silica becomes an increasing constituent of the gangue material. Iron, manganese, calcite, and fluorite are less prominent gangue constituents. The absence of silicification or propylitization of the rocks adjacent to the fissures, as well as the absence of precipitation from mineral springs of volcanic origin, are conditions unusual in Tertiary veins.

The fissures have been followed to sufficient depth on the Waterloo, King, and Oriental veins to show that the ore occurs in well-defined shoots, with a rake to the southeast in the plane of the vein. Other veins have not been opened to a greater depth than 100 ft., but at this shallow depth similar conditions are indicated. The stopes vary in width up to 30 ft. and the maximum length of an oreshoot is 1,000 ft. and the height 400 ft.

The principal value is silver, though there have been sporadic occurrences of lead and much of the ore carries \$1 to \$2 per ton in gold. In West Calico, on the Stella, Silver Bow Extension, and other claims in that part of the district, there are veins up to 35 ft. wide that outcrop for 1,000 ft. or more, which, on the surface and to a depth of 200 ft., show a very much leached condition, but containing silver values too low to be commercial, with occasional small masses of galena, anglesite, and cerrusite. One of the Burcham veins shows only gold values, on which there has been developed a block of ore containing 11,000 tons with an average content of \$10 per ton, with ore in both faces and in the bottom of the winze.

It is impossible to estimate what may have been the average content of the ores as a whole. Undoubtedly, small veinlets of horn silver have been mined that yielded several thousand ounces of silver to the ton. In the course of this examination a stringer of horn silver on the bottom level of the King vein was sampled that assayed 405 oz. silver. On the Bismarck and Golconda veins, where the ore made out from the fissures along fracture planes for a maximum distance of 200 ft. at and near the surface (which led to the statement in early days that the Calico orebodies were 200 to 300 ft. wide), native silver and horn silver can still be found occasionally.

SECONDARY ENRICHMENT

Cerargyrite (horn silver) is the principal ore mineral to the greatest depth to which development has extended. Occasionally secondary argentite is encountered, but none of the arsenic or antimony silver sulphides have been found. The occasional presence of stibnite and realgar indicates the former occurrence of antimony and arsenic in the oxidized zone. Azurite and chrysocolla are of frequent occurrence, and either is considered by the old-time miners a sure indicator of ore near by. From these mineral associations and other known facts regarding similar silver ores it is reasonable to expect that below the zone in which horn silver is the predominating silver mineral, and which has not yet been bottomed, there will be found a sec-

ondary argentite zone, and between it and the primary ore, and overlapping each of them, there will be found the rich copper, antimony, and arsenic silver-bearing minerals, tetrahedrite, pyrargyrite, proustite, and stephanite.

Exploration of Tertiary fissure veins has demonstrated that the depth to which oxidation extends, and the relations and size of the several zones of solution and precipitation, depend largely upon whether the fissures have remained open or have been capped by later flows, the composition and permeability of the ore and gangue, and the number and rapidity of changes in climate affecting precipitation. In the Calico district the fissures have been open to the passage of descending waters since they were formed, and they occur in a region subjected to the effects of the several changes in climate of late Tertiary and Post-Tertiary times. The great precipitation during the Glacial time in these areas of low altitude must have had a pronounced effect in changing and rearranging the vein fillings in this district. Taking all the factors into consideration, it is probable that, in the Calico district, the zone of solution and precipitation will be of considerable vertical extent, in which there are orebodies as yet undeveloped, since the zone of precipitation may have become one of solution, with deposition at greater depth, due to changes in climate from abundant precipitation to an arid condition succeeded by the great precipitation of Glacial and Post-Glacial times.

Lack of initial capital to invest in labor-saving methods was doubtless the reason for the generally extremely selective mining that prevailed, for most of the mines literally paid for the equipment, development, and reduction plants as the exploration of the district proceeded.

The walls of the veins are generally firm and required little timbering, the notable exception being on the south vein of the Waterloo, where square sets in stopes 20 to 30 ft. in width were used and still stand in the lower levels, unfilled and taking no weight, testifying to the useless expense that must have taken a serious toll from the profits.

All the ore was hauled by wagons to the mills (except at the Waterloo, where ore was transported several miles by a narrow-gage railroad) for distances varying from 1 to 15 miles, and this method of transportation was never changed. Future operations will no doubt transport the ore by mill-level tunnel or in some cases by aerial tram, and pump the water a distance of one-half to 1 mile and elevate it approximately 250 ft. Electric power is available within 10 miles of the district, being supplied by the Southern Sierra Power Co.

The "Boss" process, crushing with stamps, fine grinding, and amalgamation in pans, followed by settling in pans, was used in all the mills, with costs \$3.75 to \$4 per ton and 90 per cent recovery claimed. A general description of several mills may be found in the eighth and eleventh annual reports of the California State Mineralogist. On pages 511-512 of the eighth annual report, published in 1888, are given some statements as to the amount of ore and values recovered. It appears that in 1882-83 the first-class ores from the Garfield mine averaged \$750 per ton and the second-class ore \$120 per ton. During the four years 1883-86, both inclusive, the King mine milled 37,000 tons of ore having a gross recovery of \$1,355,000, from which \$450,000 was paid in dividends. From Oct. 1, 1886, to

Oct. 1, 1887, the Garfield mill treated 11,476 tons of ore, yielding 417,215 oz. of silver. No data are available to show the percentage of recovery.

Some of the ores are known to show a recovery of 90 per cent by cyanidation; others, 60 to 70 per cent. Some leaching experiments have proved quite successful. Extended experimental work is necessary to determine the economic method of ore treatment, and it is likely to be cyanidation or lixiviation rather than amalgamation.

POSSIBILITIES OF FUTURE DEVELOPMENT

The Calico district is about the last of the old mining camps in which no attempt has been made to reopen and further develop the mines in depth below the bonanza ores. The success that is attending the reopening of the Comstock district, particularly the recent discoveries in the middle section at Virginia City, may perhaps be repeated at Calico. The character of the fissures and vein filling, the mineral associations in the ores, and the probability of an enriched zone beneath the oxidized ore, are sufficient to warrant deeper development. Notwithstanding present high mining costs, modern methods of mining, transportation, and treatment will make possible a profit from ores of much lower grade, but far greater tonnage, than under the conditions existing when the district was active.

Several of the old-time Calico miners are still living at Daggett, including Frank Denning, Billy Warren, Charley Noland, Bernard, Billy LeMontain, and the three Mulcahy brothers, Jim, John, and Maurice. They possess a fund of valuable knowledge of the former mining and milling operations that will be found available to any one, as it has been to me in the progress of this examination.

The object of this paper is to put on record a general description of the district, which heretofore has had no place in the literature of mining districts and ore deposits; to set forth such facts as are readily ascertainable regarding the geologic history, rocks, fissures, and ore deposits; to discuss the probability of finding an enriched zone below the silver chloride zone, the latter not exhausted by the early mining operations; and to point out certain features indicating the possibilities of future mining operations by present-day methods that will permit the profitable treatment of low-grade ores. Detailed study of the district will no doubt modify some of the statements herein made and bring to light many facts regarding the fissures and ores that may have been overlooked in this preliminary examination and description of the district.

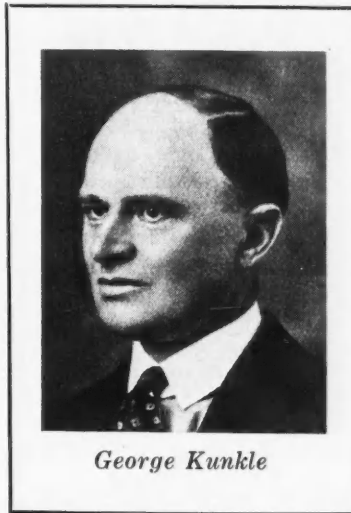
In a general way the ore deposits are similar in character and arrangement to those of other Tertiary orebodies, but a study in detail will reveal a considerable variation that will develop new ideas regarding the formation and occurrence of orebodies and the criteria to be employed in the search for new ores in other districts. Monographic study and description of the district by the U. S. Geological Survey, similar to the studies of the Tonopah and other Tertiary districts, is certainly warranted by the considerable production from shallow depth which was arrested by the decline in the price of silver, and not resumed. Such a study would aid materially in the rejuvenation of the district and in developing and working out the local ore problems, and would become a permanent addition to the technical knowledge and literature of ore deposits.

Diamond Drilling for Carnotite in Colorado

Experience Shows That Great Care Is Needed in Recording and Interpreting Results

By George Kunkle

President, Vanadium Corporation of Colorado



George Kunkle

PROSPECTING for orebodies in the carnotite fields of southwestern Colorado with the diamond drill requires unusual care. An inexperienced man is likely to be misled and to "find" orebodies where there are none. One such instance, at least, is on record. A description of methods that have proved reliable should be a valuable aid to others who may undertake similar exploration.

The area usually selected for prospecting with the diamond drill is ground where the overburden does not exceed 50 to 75 ft., although this figure may reach 100 ft. This appears to be the present limit of economical drilling. The holes are surveyed and numbered, and are sunk at distances of 25, 50, and 75 ft. apart, depending upon the possibilities assigned to the ground by the engineer in charge. Actual drilling is usually contracted. The contract price per foot will vary according to the district, its relative isolation, and the total footage to be drilled. In the past this price seldom exceeded \$0.80 per foot on a minimum 10,000 ft. contract, the company furnishing the water, the hauling, and "packing" of incidentals.

The record of the operation of a drill is kept on a daily report sheet filled in by the driller. This report sheet may provide for the name of the camp, the name of the claim, the number of the hole, its location, collar elevation, distance moved to the hole, date and hour when hole was started, and date and hour when hole was finished. Space is provided to show the number of feet drilled in each particular formation, expressed by a suitable legend or color scheme, with or without a columnar section drawn to scale; also, space to show the thickness of the orebody, the number of gallons of water used in drilling the hole, and the final color assigned to the hole on the drill map.

Drill maps may show in plan and in section the area being prospected and the formations explored with the drill. These maps and records are usually retained by the head field engineer's office, and from them special reports are issued periodically for the general office.

In this kind of work one machine will drill an average of thirty holes aggregating approximately 1,400 ft. per month, the time including movings and set-ups. The extremes may vary between 700 and 2,400 ft. in a month. This is largely governed by the total distance the drill is moved, and to some extent by the local character of the formations drilled. A typical daily drill report will read:

Drill No. 2, Camp No. 1, Claim Big Dick No. 1, Hole 375, Location 10,338 ft. N. 8,058 ft. E., Collar elevation 6,778 ft. Hole

started April 22, 1922, hour 9.30 a.m. Hole finished April 23, 1922, hour 9.30 a.m. Distance moved to this hole, 75 ft. Moving time one-half hour. Drilling time 7½ hours. Total time, 8 hours; water consumed on hole 150 gal.:

0 to 20 ft. WS (White Sandstone)	30 to 40 ft. WS (White Sandstone)	318	5,940	18.6	3.1	25.4	14.4	8.2
20 to 22 ft. RC (Red Clay)	40 to 49 ft. BS (Brown Sandstone)	228	7,712	33.8	19.2	20.1	20.1	5.3
22 to 25 ft. BS (Brown Sandstone)	49 to 50 ft. YC (Yellow Clay)	504	20,400	40.6	8.4	15.6	5.7	4.1
25 to 30 ft. BC (Blue Clay)		362	15,551	43.0	8.1	13.5	0.0	4.8

Color assigned to this hole on drill map, Blank.

To facilitate mapping, red holes may indicate ore containing 3 per cent, or better, of U_2O_5 ; yellow holes may indicate workable orebodies of uranium and high-grade vanadium, green holes may indicate orebodies of vanadium, and light green may indicate ore stain.

THIRTY-EIGHT MONTHS' RECORD

The following tabulated data represent a combined total of about thirty-eight months of drilling, which was done concurrently by three different drilling crews and drills. For obvious reasons, the names of the camps and claims and dates are omitted:

Drill No. 3 Camp No. 3 Month	Red	Yellow	Green	Stain	Blanks	Total Number Holes	Footage
1	0	0	0	0	9	9	553
2	2	0	9	0	21	32	1,369
3	2	0	6	0	32	40	1,748
4	1	1	10	0	47	59	2,612
5	0	1	0	10	29	40	1,711
6	0	0	16	0	19	35	1,746
7	4	1	10	0	9	24	1,374
8	2	5	11	0	8	26	1,110
9	3	0	9	0	27	33	1,466
10	6	2	2	8	15	33	1,208
11	2	4	4	5	32	47	1,665
12	5	2	2	6	43	58	1,880
13	0	0	0	0	61	61	1,958
Totals	27	16	79	29	352	504	20,400
Percentages	5.3	3.1	15.6	5.7	70	100	

The corresponding percentages for 49,603 ft. of hole are 4.7, 4.4., 18, 8, 64.1, and 100. In analyzing the above-recorded data the percentage of holes showing ore should not be interpreted as representing the percentage of ground prospected, which is underlain with ore or orebodies. Often a red hole showing from 4 to 5 in. of high grade will not yield more than one or two sacks of ore, and it is exceedingly rare that the entire area lying within the radius of a series of live holes will be continuously underlain with commercial ore. Nor should these results be accepted as an index to the general distribution of these orebodies in carnotite-bearing strata. The results shown were obtained only in proven ore-bearing territory and on exceptionally good claims, having excellent past production records. I am acquainted with the results obtained from several hundred holes drilled in perfect carnotite-bearing strata in unproven territory, and more than 99 per cent of these holes gave negative results.

A drill-map analysis of the data herewith presented, and also about 75,000 ft. not included in the tables given above, indicates that the major axes of the large orebodies (lenses) lie in a northwesterly direction; and in one remarkable instance a drill-line survey projected on this theory by a well-known geologist employed in this work disclosed, in an entirely different and distant group of claims, one of the largest orebodies found by the drills.

One more general effect, and one which might have been anticipated, is the scattering and dissipation of orebodies due to the weathering of their protective capping and superficial overburden. This is shown in the following arrangement of the results tabulated in this rotation—Camp 3, Drill 2; Camp 2, Drill 1; Camp 3, Drill 3, and Camp 1, Drill 1.

Total Number of Holes	Total Footage Drilled, Ft.	Over- burden, Average Depth per Hole, Ft.	Per Cent Red and Yellow Holes	Per Cent Green (Vana- dium) Holes	Per Cent of Holes Showing Ore Stain	Water Used per Foot in Drilling Gal.
318	5,940	18.6	3.1	25.4	14.4	8.2
228	7,712	33.8	19.2	20.1	20.1	5.3
504	20,400	40.6	8.4	15.6	5.7	4.1
362	15,551	43.0	8.1	13.5	0.0	4.8

It will be noted that geochemical action, due to surface waters, is roughly proportional to the depth of the overburden. The percentage of holes showing ore stain increases as the overburden diminishes, and conversely. This weathering of the protective capping is also shown by the consumption of water per foot drilled.

Owing to stagnation in the carnotite industry during the last four to five years, all of the orebodies recorded as having been drilled, in the accompanying tables, have not yet been mined; consequently, nothing definite can be said as to the cost of this type of prospecting figured in pounds of recovered uranium oxide. However, most of the promising orebodies drilled at Camp No. 3, by drills Nos. 2 and 3, have been mined. This work represents a total of 26,340 ft., at a cost of approximately \$1 per foot. The orebodies disclosed have yielded approximately 19,000 lb. of U_2O_5 , which includes grades now too low to ship, but formerly of commercial value. This indicates roughly a prospecting cost of \$1.38 per pound of commercial U_2O_5 , or \$82.80 per ton of an unmined ore containing 3 per cent of U_2O_5 . The data do not take into consideration the benefit derived from holes showing only vanadium or ore stain, which are used as indicators in further prospecting, nor the general benefit derived from a more accurate knowledge of the deposition of these ores.

ENGINEERING SKILL MUST DIRECT OPERATIONS

Finally, to those who may find it necessary to review the diamond drill records of a property, it may be said of the value of such records that much depends upon the ability of the engineer who had charge of the drilling. Granting his natural keenness to eliminate any carelessness on the part of workmen, there is still his personal viewpoint and the stress placed upon certain showings, which determined his classification of the holes, and their entry as such, upon the drill maps.

The greatest single source of error is in checking up the work and reports of the driller. The following is typical: It is well known to drillers that this ore, being soft and friable, does not core well. Consequently, it became the custom of many drillers to estimate the thickness of an orebody by the number of feet drilled, during the interval that the water emerging from the hole showed ore-bearing sediment. By washing, caving, and attrition of the orebody, due to the centrifugal motion of the water in the hole caused by the rotation of the drill, a 1- or 2-in. seam of soft ore would continue to furnish ore-bearing sediment long after the drill had entirely passed through it. If ore-bearing sediment continued to show in the emerging water until several feet of hole had been drilled, the orebody was reported as being of corresponding thickness, and this error passed unchecked upon the drill maps and other records vitally concerning the property.

Such mistakes were undoubtedly committed by the first operator who undertook this work, and it is probable that they have been repeated in some degree by the engineering staff of every operator subsequently engaged. At the present stage of the work it is best to accept only with healthy reservations any calculations of ore reserves from engineers inexperienced in mining the ores which they formerly "blocked out."

A Study of Temperature in a Two-Stage Air Compressor

Results of a Test Made at University of California to Determine Causes of Heating in Such Equipment

By Walter S. Weeks, Chris F. Milisich, and Herbert Le C. Berteaux

University of California, Berkeley, Calif.

AN OCCASIONAL EXPLOSION in an air-compressor plant attracts attention to the causes of high temperatures in such equipment, which include (1) lack of lubrication, (2) lack of cooling water, (3) throttling the intake, which causes the air to be taken in at low pressure, and so results in a high ratio of compression; (4) leaky discharge valves, which allow hot air from the receiver to return to the cylinder, to be recompressed and discharged.

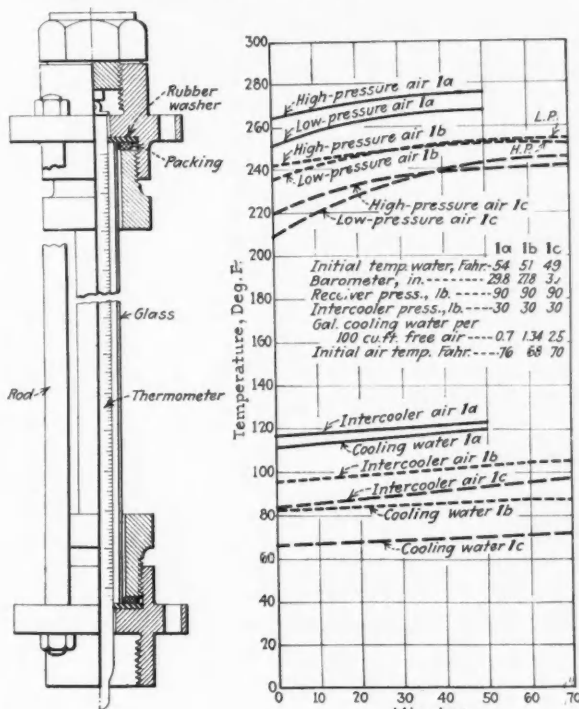


Fig. 1—Thermometer mounting
Fig. 2—Effect of variation in amount of cooling water used

The results of tests at the University of California, in the spring of 1923, may prove interesting. Experiments were made on a Sullivan WJ 3, two-stage compressor, in good mechanical condition, of the following dimensions: Low-pressure cylinder, 11-in. diameter; high-pressure cylinder, 8 1/2-in. diameter; stroke, 10 in.; speed, 210 r.p.m. The equipment included low-pressure unloader that closed the intake and was operated by air from the receiver, and a high-pressure unloader that opened the high-pressure cylinder to the atmosphere when the air in the intercooler was exhausted in consequence of the closing of the low-pressure intake. A stop valve was placed on the high-pressure unloader, so that it became inoperative; if no pressure could develop in the cylinder, the only cause of heat would be the friction of the air through the unloader valves. The inlet valves on the compressor were of

the rotating and the discharge valves of the poppet type. Air temperatures were taken, unless otherwise stated, (1) in the pipe between the low-pressure cylinder and the intercooler, (2) in the pipe between the intercooler and the high-pressure cylinder, and (3) in the discharge pipe close to the high-pressure cylinder.

The temperature of the cooling water was taken as it left the compressor. The thermometers on the compressor were placed directly in the path of the air by means of the arrangement shown in Fig. 1. Ordinary boiler gage glasses were used. The thermometers were tied in at the top to withstand suction when the compressor was unloaded. The air delivered was measured by means of a low-pressure orifice meter. The auxiliary apparatus worked satisfactorily, and might well be included in permanent equipment, so that unusual rise in temperatures might be noted.

No study was made of the effect of insufficient lubrication. The results of the experiments on variation in amount of cooling water used are shown in Fig. 2. The compressor was operated without throttling. For a flow of 0.7 gal. per 100 cu.ft. of free air delivered, the cooling water was raised nearly to the temperature of the intercooler air. No serious heating took place, but it was evident that the minimum in water requirement had been reached. By increasing the flow to 1.34 gal. per 100 cu.ft. of free air delivered, the temperature of the air was lowered considerably, and the intercooler and water temperatures differed by about 14 deg. F. A further increase in water to 2.5 gal. did not materially lower the temperature of the air, thus indicating that sufficient water was being used.

In practice, the operator should determine the volume of cooling water that gives a reasonable temperature, and set the valves accordingly. A stoppage or shortage of water will result in the development of a high temperature in a compressor, a contingency that should be guarded against. Fig. 3 illustrates a method whereby the operator is warned in time: A tank is arranged to receive the water from the compressor, which overflows the top and through the valve A at the bottom. The valve is set so that the head H will discharge the minimum allowable amount. If the flow drops below this, the water no longer overflows, and the water level in the tank drops. The float B makes a contact and rings a bell.

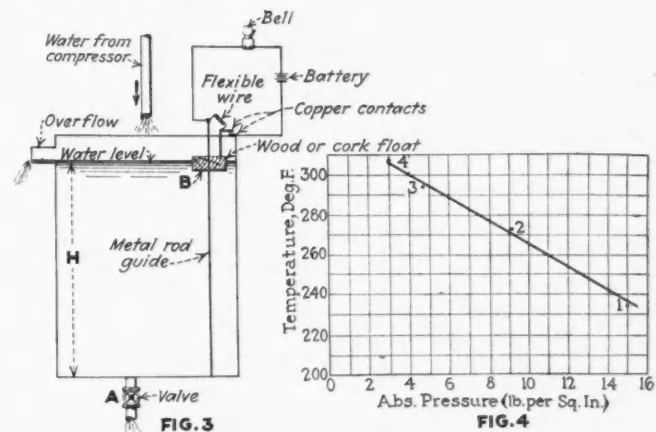


Fig. 3—Low-water alarm
Fig. 4—Effect of throttling the intake

High-pressure unloader closed. Temperatures attained at discharge of high-pressure cylinder after running forty minutes plotted against absolute intake pressures in low-pressure cylinder taken from indicator cards. Rate of flow of cooling water, 5.7 gal. per minute. Initial temperature of air, between 65 and 72 deg. F.

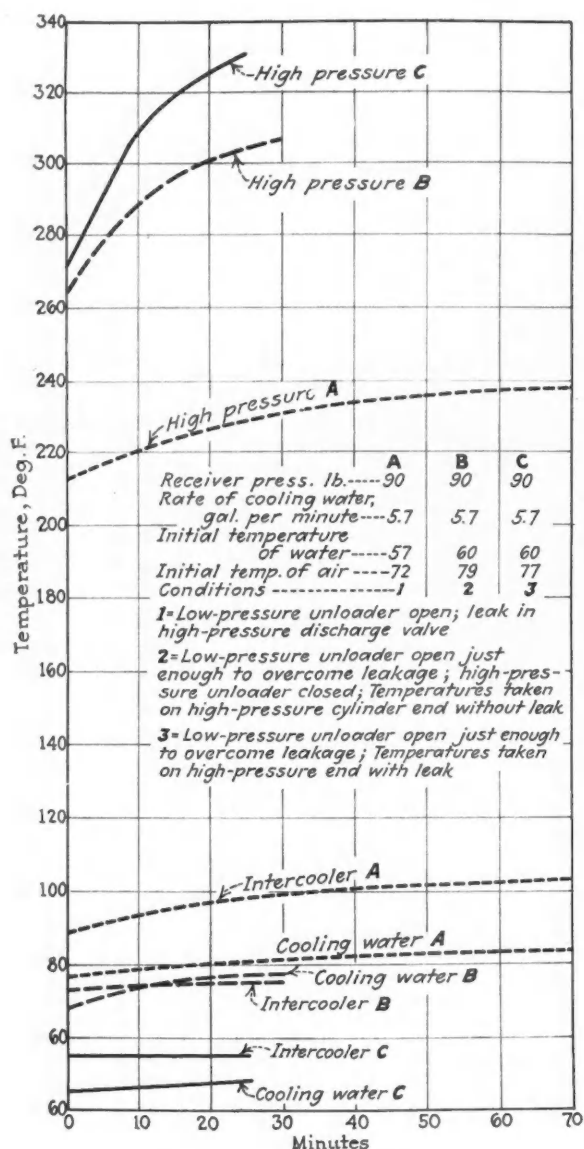


Fig. 5—Effect of leaky discharge valve

Tests were made to determine the effect of throttling the intake of the low-pressure cylinder, the high-pressure unloader being closed meanwhile so that air taken in was discharged into the receiver. Fig. 4 shows the final temperatures, representing equilibrium conditions, attained after forty minutes' operation in several runs with different degrees of throttling. The absolute pressure in the low-pressure cylinder gives an idea of the degree of throttling. The intake pressures were taken from indicator cards. The "curve," which is nearly a straight line, shows that as the intake pressure decreases the final temperature increases, but not at a high rate. If the air be throttled, no opportunity occurs for the development of a high temperature, the weight of air passing through the machine being so small that the cooling system is able to remove the heat effectively, obviating danger unless the supply of water fails. This condition also holds with the high-pressure unloader closed or out of order.

The effect of a leaky valve was determined by boring two $\frac{1}{8}$ -in. holes in one of the poppet discharge valves. Fig. 5 shows the result when the compressor was under load. The temperatures were normal, the conclusion reached being that, if a normal flow of air is

passing through the compressor, a leak in the discharge valves does not cause an increase in the temperature. The heat does not accumulate, but is carried away by the flow of air.

To determine the effect of throttling a compressor with a leaky valve, a thermometer was placed in an indicator hole in the cylinder. To make a comparison, the temperature was first taken in an indicator hole on the cylinder end, with no leak in the discharge valve. This, shown graphically in Fig. 4, became constant at about the value expected for the degree of throttling. The thermometer was then transferred to the end with the leak. In slightly over twenty minutes the final temperature rose to 330 deg. F. The compressor was then shut down.

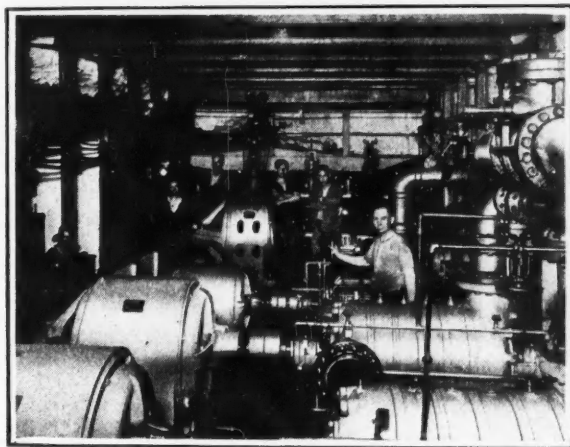
The following conclusions were drawn: (1) High temperature does not occur when the compressor is running loaded, unless lubrication or cooling water is lacking; (2) dangerous temperature will not result from throttling the intake unless there is also a failure of cooling water; (3) dangerously high temperatures are caused when a compressor with leaky discharge valves unloads, unless provision is made for the escape of the air from the high-pressure cylinder to the atmosphere, or other steps are taken to prevent the accumulation of heat. The greatest hazard is with a single-stage machine; throttling results in a higher temperature than would be reached under similar conditions in a two-stage machine, on account of inadequate cooling. Throttling a compressor having leaky discharge valves will cause a high temperature unless the cylinder is open to the atmosphere. The operator should use a good grade of lubricating oil and plenty of water, and see that the discharge valves seat properly. When a compressor shows signs of heating, and it is necessary to keep running to finish a shift, the oil and water should first be examined. If the provision of these is satisfactory, the compressor should be prevented from unloading, by setting the unloader valve above the safety valve or by discharging the air by hand when it is in excess of requirements. Discharge valves should be cleaned and properly seated when necessary. The removal of dust from the intake air will aid greatly in keeping the valves clean and tight.

Spalling of Fireclay Brick Investigated

Results of a fundamental investigation made to study the physical factors involved in the spalling of fireclay brick were given by M. C. Booze, senior fellow of the Refractories Fellowship, Mellon Institute, at the recent meeting of the American Refractories Institute in Pittsburgh. It was shown that of the three factors coefficient of expansion, diffusivity, and elasticity the latter was the most important, owing to the fact that it could be varied over wider limits than either of the others and also that it was the only one which varied directly with the results of spalling tests. Greater variations in coefficients of expansion for mixtures varying in composition and structure were obtained than was anticipated, but it happened that those with lowest expansion spalled the most readily, proving that this property is not the most important in affecting spalling. The average coefficient of expansion was also found to be lower than the value ordinarily used by engineers in making allowance for expansion of furnace walls.

A Southwestern Pumping Plant

The pumping plant shown in the accompanying illustration is one of the underground pumping stations of the Old Dominion Copper Co.'s mine at Globe, Ariz. The water is pumped into a reservoir above ground, from which the Miami Copper Co. and the town of



An underground pump station, Old Dominion Copper Co., Globe, Ariz.

Globe receive their water supply. The pumps are driven by thirteen General Electric motors, aggregating 2,875 hp. The average rate of pumping is 4,500,000 gal. of water per day, the rate varying from 3,000,000 to 8,000,000 gal. per day. Pumping is continuous, twenty-four hours for every day in the year.

During 1915 unusual conditions forced the maximum pumping rate up to 13,000,000 gal. per day. At that time two of the 250-hp. motors were submerged, but were later dried out and found to be unharmed.

He Says So Himself

Following is the exact copy of a letter received by a mine operator in Arizona recently:

HERE IS THE ONLY TRUE DIVINE
OIL SEER
THE WORLD HAS EVER KNOWN
UP TO THE PRESENT TIME.

Guarantees 95 per cent.

No Fake In Statement. Distance Cuts No Figure.

A. D. MONROE

Dec. 10th, 1922
Barstow, Calif.

Precedent of
Humboldt Mining & Smelting Co

Dear Sir: how are you first, could you in vest in a great silver prospect. I have four clames a solid body of Horn silver it's more then 20 veins wich I can open up running fro four to 27 feet in with working on one twelve 12 feet round and loded with mineral bright to surffis and dugue in to three more one on each claim this is a bottomless basin wich every body has over lookt be cause its covered over an 4 miles from two silver mines in this locality. the most idle spot for a smelter in the hole west do you by any ore on the car and advense any money on it as I am brook bean here for two and one half yeare — bean in city only two nights. so you may know I am a strager have been laught at more then onc, but I have more then I know what to do with now what do you charge pr tun, bout how much would I realice on \$100 ore could you pleas let me know, an 4 miles of Barstow if you want sampel will send you som pleas let me hear from you and oblige

(Signed) A D Monroe

Recovering the Maximum Quantity of Oil

*Logical Way Is to Use the Gas More Efficiently
Rather Than to Provide More Openings,
Thus Assuring Conservation*

By S. F. Shaw

Mining and Petroleum Engineer, San Antonio, Texas

IN AN ARTICLE¹ published some time ago, the conclusion was stated that "to obtain a maximum yield the recoverable oil should be secured as quickly as possible and by relatively close spacing." This statement was based on observations made by the authors of the article and on observations of the U. S. Bureau of Mines. I am not in accord with the conclusion that closer spacing of wells will be as productive of results as other methods will be that can be employed. In the article referred to the following statements are made:

"Gas is one of the principal motive forces which propels or carries the oil through the sands into a well and causes the well to flow or gush. . . . It is more mobile than the oil and flows or moves more rapidly through the voids in the reservoir rocks. . . . At depths found in the oil fie'ds the gas is frequently under heavy pressure. When this pressure is released by the drilling of a well the gas moves toward the outlet, carrying oil with it. Because of its much greater mobility the gas moves more readily than the oil, and there is a tendency as the pressure is released for some of the gas to become dissociated from the oil and for the oil to lag behind the gas in its movement toward the well. To obtain the maximum work from the gas the pressure must be conserved as much as possible in the reservoir rocks, and the distance which the gas has to carry the oil through the sands to the well should not be too great."

CLOSER SPACING OF WELLS NOT NECESSARY

So far as I know, the above statements express the latest conclusions as regards the relation of the oil, and of the gas that occurs in association with the oil, in the underground reservoir, but it does not follow that closer spacing of wells than the usual practice calls for is necessarily the most effective means of achieving the results desired. In the first place, closer spacing of wells entails a more rapid lowering of the gas pressure, which in turn results in slower movement of the oil through the sands, and it is, in general, open to question whether in the meantime a sufficiently greater quantity of oil will have been recovered to offset the expenditure for a greater number of wells, and for the additional production costs. The trouble lies not so much in the need of a larger number of outlets for the oil and gas as in the need of a means of utilizing the associated gas to best advantage, both for propelling the oil through the sands to the well and for lifting the oil from the bottom of the well to the surface.

We have no device at present for controlling the flow of gas and oil through the sands that can be installed within the underground reservoir, but we can control the movement of the oil and gas through the well casing. Attempts have been made in California, Oklahoma, Texas, Wyoming, and elsewhere to control the gas by the use of "beans," "chokers," "flow-nipples," and other devices, but judging from the results given in the only data I have seen published, these expedients leave much to be desired. In a paper presented by John M. Lovejoy before the Institute of Petroleum Geologists

¹"More Oil Through Closer Spaced Wells," by G. C. Gester, S. H. Gester, and E. W. Wagye. *Oil and Gas Journal*, Jan. 10, 1924

Data Showing Gas Consumption in Raising a Barrel of Oil to the Surface

Date Average Five Days, Beginning	Average Back Pressure, Pounds	Total Oil Production, Barrels	Total Gas Volume, Cu. Ft.	Gas Volume per Barrel of Oil, Cu. Ft.	Cu. Ft. of Gas Required at 100 per Cent Efficiency	Per Cent of Efficiency Obtained
January 1.....	12	950	1,150,000	1,220	70.7	5.8
January 16.....	15	975	1,150,000	1,220	70.7	5.8
January 26.....	0	925	1,300,000	1,300	70.7	5.4
February 10.....	0	1,200	1,375,000	1,160	70.7	6.1
April 1.....	32	1,100	1,500,000	1,360	70.7	5.2
May 6.....	0	1,160	1,320,000	1,070	70.7	6.6
June 20.....	0	1,005	1,275,000	1,270	70.7	5.6
July 10.....	76	510	850,000	1,620	70.7	4.4
August 19.....	48	500	720,000	1,400	70.7	5.1
September 13.....	49	350	490,000	1,320	70.7	5.4
September 1-20.....	0	551	554,500	1,006	70.7	7.0
September 21-25.....	50	155	129,405	834	70.7	8.5

in Tulsa in 1923, some valuable data on this subject were given showing the amount of gas consumed in raising a barrel of oil to the surface. The figures that have a bearing on this discussion taken from the article mentioned are found in the first four columns of the table at the top of this page.

The conditions that must be known before calculations for efficiency can be made are not definitely stated in Mr. Lovejoy's paper, and therefore it is necessary to assume figures supposed to be a fair approximation, as follows: Depth of well, 2,000 ft.; closed-in pressure

would result in a much greater conservation of the gas than is now obtained, and a proportionately greater quantity of oil would eventually be recovered.

It is naturally desirable to utilize the gas in raising the oil to the surface: this makes for lower production costs. It is therefore highly desirable to continue the flowing conditions as long as possible. The control and conservation of the gas therefore serves a double purpose, in that it maintains a larger period of propulsion of oil through the sands to the well and a longer flowing period for the well.

Cubic Feet of Free Gas, Sea-level Basis, at Given Pressure, Theoretically Required to Raise One Barrel of Water of 42 Gallons to a Given Height

Feet Lift	Pounds per Square-inch Pressure at Inlet of Flow Pipe													
	100	125	150	175	200	225	250	275	300	400	500	600	700	800
100	8.064	7.35	6.856	6.468	6.157	5.922	5.712	5.544	5.397	4.952	4.649	4.431	4.259	4.057
200	16.128	14.70	13.692	12.936	12.314	11.844	11.424	11.088	10.794	9.904	9.298	8.862	8.518	8.114
300	24.192	22.05	20.538	19.404	18.471	17.766	17.136	16.632	16.191	14.856	13.947	13.293	12.777	12.171
400	32.256	29.40	27.384	25.872	24.628	23.688	22.848	22.176	21.588	18.808	18.596	17.724	17.036	16.228
500	40.320	36.75	34.230	32.340	30.785	29.610	28.560	27.720	26.985	24.760	20.245	22.150	21.295	20.285
600	48.384	44.10	41.076	38.808	36.942	35.532	34.272	33.264	32.382	29.712	27.894	26.586	25.554	24.342
700	56.448	51.45	47.922	45.276	43.099	41.458	39.984	38.808	37.779	34.664	32.543	31.017	29.813	28.399
800	64.512	58.80	54.768	51.744	49.256	47.376	45.696	44.352	43.176	39.616	37.192	35.448	34.072	32.456
900	72.576	66.15	61.614	58.212	55.413	53.298	51.408	49.896	48.573	44.568	41.841	39.879	38.331	36.513
1,000	80.640	73.50	68.460	64.680	61.570	59.220	57.120	55.440	53.970	49.520	46.490	44.310	42.590	40.570
1,100	88.704	80.85	75.306	71.148	67.727	65.140	62.832	60.984	59.367	54.472	51.139	48.741	46.849	44.627
1,200	96.768	88.20	82.152	77.616	73.874	71.064	68.544	66.528	64.764	59.424	55.788	53.172	51.108	48.684
1,300	104.832	95.55	88.998	84.084	80.041	76.986	74.256	72.072	70.161	64.376	60.437	57.603	55.367	52.741
1,400	112.896	102.90	95.844	90.552	86.198	82.908	79.968	77.616	75.558	69.328	65.086	62.034	59.626	56.798
1,500	120.960	110.25	102.690	97.020	92.355	88.830	85.680	83.160	80.955	74.280	69.735	66.465	63.885	60.855
1,600	129.024	117.60	109.536	103.488	98.512	94.752	91.392	88.704	86.352	79.232	74.384	70.896	68.144	64.912
1,700	137.088	124.95	116.382	109.956	104.669	100.674	97.104	94.248	91.749	84.184	79.033	75.327	72.403	68.969
1,800	145.152	132.30	123.228	116.424	110.826	106.596	102.816	99.792	97.146	89.136	83.682	79.758	76.662	73.026
1,900	153.216	139.65	130.074	122.892	116.983	112.518	108.528	105.336	102.543	94.088	88.331	84.189	80.921	77.083
2,000	161.280	147.00	136.920	129.360	123.140	118.440	114.240	110.880	107.940	99.040	92.980	88.620	85.180	81.140
2,100	169.344	154.35	143.766	135.824	129.297	124.362	119.952	116.424	113.337	103.992	97.629	93.051	89.439	85.197
2,200	177.408	161.70	150.612	142.296	135.454	130.284	125.664	121.968	118.734	108.944	102.278	97.482	93.698	89.254
2,300	185.472	169.05	157.458	148.764	141.611	136.206	131.376	127.512	124.131	113.896	106.927	101.913	97.957	93.311

300 lb. per square inch; specific gravity of the fluid, 1. It is probable that these assumed figures are not exactly those of the actual conditions, but they serve to illustrate my point. The columns headed "Cubic Feet Gas Required at 100 per Cent Efficiency," and "Per Cent of Efficiency Obtained" are supplied by myself. The first of these two columns is obtained by interpolation from the next table, which I have also prepared.

It will be noted that the efficiencies range from 4.4 to 8.5 per cent, and are probably as high as can be obtained by the use of the present system of back pressure obtained by the use of flow-nipples and the like. The logical procedure to follow in cases where the efficiencies are low is to utilize the gas in a manner that will raise this percentage, rather than attempt to provide a greater number of openings through which the gas would escape in the same inefficient manner as heretofore. I have increased efficiencies obtained in air-lift work from 50 to 100 per cent over the usual manner of handling air-lift operations as employed in oil-well practice, and as the installations of casing through which gushers flow when they first come in, and also of tubing through which flowing wells of small production are allowed to flow, are similar in principle to the usual air-lift installations, it is logical to assume that a flow line designed for gushers and for small flowing wells along plans like those that I have followed

Bauxite in 1924

The production of bauxite in the United States in 1924 was 346,553 long tons, valued at \$2,131,908, a decrease of 34 per cent in quantity and 32 per cent in value as compared with the domestic production in 1923, according to a statement prepared by James M. Hill, of the U. S. Geological Survey.

Bauxite Produced in the United States in 1923 and 1924.

Year	(Long tons)		
	Production	Imports	Exports(a)
1923.....	522,690	119,020	78,560
1924.....	346,553	201,974	77,065

(a) Largely bauxite concentrates.

Domestic Bauxite Sold by Producers to Industries in 1923 and 1924

Year	(Long tons)			Total
	Aluminum	Chemicals	Abrasives, Refractories, and Cement	
1923.....	380,520	68,870	73,300	522,690
1924.....	225,774	53,859	66,920	346,553

The production of bauxite in the Arkansas field was 326,616 long tons in 1924, a decrease of 167,264 tons compared with 1923. The eastern field decreased its output over 8,000 tons, the production in 1924 being 19,937 tons from Georgia and Tennessee. No bauxite was produced in Alabama in 1924. The imports of bauxite in 1924 were 201,974 tons.

Sulphur, Sulphates, and Sulphides as Fertilizers

*Experiments With Them Have Resulted in
Increased Yields of Crops to Which
They Were Applied*

By George Schumacher

Metallurgist, Box 1096, Medford, Ore.

IN THE MINING INDUSTRY large amounts of sulphur in one form or other remain undigested, for which in the form of fertilizers a market would be very welcome. As will be shown later in this article, sulphur and sulphates act as direct fertilizers. They are absolutely essential for plant development. No secondary action, such as liberation of phosphorus, nitrogen, or potash, is responsible for the remarkable increase of yields on plant growth if sulphur, sulphates, or sulphides are applied.

It has, of course, been known since chemists learned to analyze vegetable and animal matter that sulphur forms part of most vegetables and farm products, and that all animal matter contains it. Even without analysis the presence of sulphur in eggs is brought to our senses as soon as they become old, and everybody knows that gases of rather ill-smelling character are produced by cabbage in or outside of the intestines.

SULPHUR CONTENT OF PLANTS LONG DISREGARDED

For a long time the practice of analyzing the ash content of plants for inorganic matter caused the agriculturist to neglect the importance of the sulphur con-

responsible for the extraordinary yields, if gypsum or superphosphates be used, but solely the sulphur content of the fertilizers; that the same or even better results could be produced with sulphur alone or with sulphates, and that it did not matter if these sulphates were sulphate of ammonia, sulphate of lime, sulphate of potash or sodium, or sulphate of iron. The possibility of using sulphate of iron as a fertilizer is of course of great interest to the mining and metallurgical industry.

MATERIAL INCREASE OF HAY PRODUCTION FOLLOWS USE OF SULPHATE OF IRON

Table I shows the results of applications of sulphur in various forms on alfalfa on experimental plots 2x8 rods in size. The last year of the experiment was very dry, and the yield was no doubt influenced by the adverse climatic conditions. The fertilizers were applied in the first year only.

This first series of experiments proved:

1. The extraordinary increase of hay produced on all plots where sulphur in one form or another was applied.
2. The rapid action of soluble sulphates and the somewhat slower action of ground sulphur.
3. That rock phosphate had no effect.
4. That the most soluble sulphate used in this experiment gave the best results and that this sulphate was *sulphate of iron*.

The yields alone, however, do not tell the true story. The unfertilized check plots and the plot treated with rock phosphate were full of weeds and the actual content of alfalfa in the hay was only 39 per cent. All sulphur-treated plots, however, produced an excellent hay practically free from weed.

Table I

Plot	Application	Pounds	Fertilizer Constituents	Pounds	Yields in Pounds				Total
					First Year	Second Year	Third Year	Fourth Year	
1	Check.....				299	96	76	38	509
2	Gypsum.....	59.5	Sulphur.....	10.0	1,088	984	608	214	2,894
3	Monocalcic phosphate.....	41.0	Phosphorus.....	9.6	318	142	94	52	606
4	Superphosphate.....	82.3	Phosphorus.....	7.4	1,092	964	600	216	2,872
			Sulphur.....	10.0					
5	Check.....				216	67	66	70	419
6	Sulphur.....	10.0	Sulphur.....	10.0	528	1,054	740	230	2,552
7	Sulphur.....	30.0	Sulphur.....	30.0	1,002	1,076	756	206	3,040
8	Iron sulphate.....	84	Sulphur.....	10.0	1,122	1,156	896	272	3,446

tent of plants, because often the largest part of the sulphur in plants is combined with organic matter and so escapes the analyst if he makes the sulphur determination from the ash content only.

It is, however, interesting to see that the farmer has used sulphur as fertilizer unconsciously, in the form of gypsum and superphosphate, ever since mineral fertilizers began to be used, believing that the lime content of the gypsum and the phosphorus of the acid phosphate alone were responsible for the beneficial results obtained by the application of these fertilizers. During the last thirty years, investigations carried out in the United States and abroad have established the fact that oats, cowpeas, cabbage, beans, kale, turnips, clover, alfalfa and the like contain considerable amounts of sulphur not to be found in the ash content. The direct application of sulphur brought remarkable results in the yield of cabbage in France, of alfalfa in Oregon, and elsewhere. Occasionally, increased yields were reported in ground containing pyrites.

A very valuable series of experiments, most interesting to the mining industry, was carried out during recent years by Prof. F. C. Reimer, of the experiment station at Talent, southern Oregon. These experiments established the facts that neither phosphorus nor lime is

Several years ago I made the same observation without thinking that sulphate of iron would act as a direct fertilizer. I had an alfalfa field treated with sulphate of iron as an experiment to get rid of the weeds. The result was very satisfactory, and I considered at that time the increased yield to be due to other fertilizers and was satisfied with the elimination of the weeds.

It is evident that the figures presented in Table I show conclusively that a liberation of phosphorus is not responsible for the increase of hay, which, on the plot treated with sulphate of iron, was nearly seven times as large as the untreated plot.

That neither the liberation of potash or nitrogen is responsible for the beneficial effects by an application of sulphur is proved by Table II.

This series of experiments was carried on for three years only on the same sized plots as before and with alfalfa. The results were identical with those of the first series, proving the value of sulphates as fertilizers and that they are direct fertilizers and do not induce secondary actions responsible for the increased yields.

If iron sulphate has such a beneficial effect on alfalfa, it might be presumed that pyrites also would act favorably on alfalfa, although the transformation of pyrites

is slow and most likely complicated in the presence of lime carbonates.

Table III shows an experiment carried on for two years only so as to find out what influence pyrites has and also if lime without any sulphur would have any beneficial effect on alfalfa in the same kind of soil.

All the experiments represented in Tables I, II, and III were carried on with alfalfa and on soil comparatively rich in lime, magnesia and potash but poor in

The beneficial effect of acid phosphate in most cases may be due to both sulphur and phosphorus, but the above recorded experiments prove without doubt that under certain circumstances the sulphur, and the sulphur alone, is responsible for the fertilizing action of acid phosphate. The tendency to make concentrated soluble phosphate may be of very doubtful value to the farmer, if in such case he loses the sulphuric acid frequently considered as a ballast only. Experiments

Table II

Plot	Application	Pounds	Fertilizer Constituents	Pounds	Yields in Pounds			Total
					First Year	Second Year	Third Year	
1	Check				49	104	44	197
2	Sulphur	60	Sulphur	60	370	532	176	1,078
3	Sulphur	10	Sulphur	10	284	708	208	1,200
4	Sulphur	30	Sulphur	30	482	672	212	1,366
5	Gypsum	59.5	Sulphur	10	789	652	200	1,641
6	Monocalcic phosphate	31.6	Phosphorus	7.47	118	100	68	286
7	Superphosphate	82.3	Sulphur	10.00	772	652	224	1,648
			Phosphorus	7.47				
8	Muriate of potash	53.3	Potassium	44.20	80	136	96	312
9	Sulphate of potash	59.4	Potassium	44.20	596	692	240	1,528
			Sulphur	10.00				
10	Check				138	144	48	330
11	Nitrate of soda	55.8	Nitrogen	8.57	154	120	44	318
12	Sulphate of ammonia	42.3	Nitrogen	8.57	772	516	180	1,468
			Sulphur	10.00				
13	Iron sulphate	86.9	Sulphur	10.00	754	628	200	1,582
14	Sulphate of magnesium	78.2	Sulphur	10.00	834	648	172	1,654
15	Sulphate of sodium	103.3	Sulphur	10.00	648	608	160	1,416
16	Check				94	140	44	278

phosphorus and nitrogen. As alfalfa is able to assimilate nitrogen from the air, it could be foreseen that an application of nitrogen would be of no benefit, but of great importance is the behavior of the soluble and insoluble phosphates.

Although the more soluble calcium sulphides were not used for systematic tests, experience with lime sulphur spray shows that this sulphide acts also as a fertilizer. Whenever such spray material is spilled on the ground a more luxurious growth of vetch, clover, and similar plants results. The beneficial results of sulphur application on vetch, clover, peas, and beans are apparent. The protein content of the hay influenced by sulphur is higher than in hay not treated with it, and the vigorous development of the root system underground and the overground part of the plant must be responsible for killing out the weed. The disappearance of grasses can hardly be caused by the sulphur direct. To try this, I treated grasses with fairly large doses of ammonium sulphate, and the result was better than a treatment with nitrate of soda.

If sulphur is used on a lime-free soil, no effect is noticeable. In fact, the resulting acidity of the soil is harmful. The sulphur must be able to combine with

carried on at present, but not concluded, may prove that rock phosphate alone, with an addition of ground sulphur or a soluble sulphate, has the same effect as superphosphate.

For the mining industry the possibility of using all kinds of soluble sulphate as fertilizers, especially sulphate of iron, should be of great interest, as iron sulphates or calcium sulphides could be produced either without great expense or are already unsalable by-products. The fixation of SO_2 in a simple way with the possibility of using the dry end product as a cheap fertilizer is especially attractive for the metallurgist.

It is advisable for the mining industry to stimulate experimentation with sulphur and sulphates under all possible conditions and to ascertain the value of these for fertilizers for the farmer and market gardener. For years I have carried on experiments with sulphur and sulphates in my garden and have noticed nearly always the beneficial effect of such treatment on most of our ordinary vegetables. But only through systematic experimentation should definite conclusions be made.

The fact alone that sulphur is a fertilizer will not make it salable. The final answer will be given by the

Table III

Plot	Application	Pounds	Fertilizer Constituents	Pounds	Yields in Pounds			Total
					First Year	Second Year	Third Year	
1	Check				152	44		196
2	Pyrites	47.68	Sulphur	19.22	240	140		380
3	Pyrites	47.68	Sulphur	19.22	270	144		420
4	Sulphur	10	Sulphur	10.00	628	212		840
5	Gypsum	59.50	Sulphur	10.00	704	256		1,020
6	Quicklime	200.00	Lime	200.00	168	56		224
7	Ground limestone	200.00	Lime	112.00	172	48		220
8	Check				148	52		200

a base, and lime seems to be the best medium. However, iron sulphate is taken up by plants very rapidly.

I have carried on a number of experiments with iron sulphate in an attempt to influence the color of the wood in living trees. The tannin content of the wood in combining with sulphate of iron will produce grayish or even black-colored wood, and the influence of the iron sulphate can be traced very rapidly, if larger quantities are used, as even the leaves begin to show dark-colored veins within a few days.

monetary return the farmer gets by its application. If he can be shown that an application of \$3 worth of sulphate of iron will produce \$30 worth of hay more than without it, he will use it. But he must be shown. If sulphates alone act as fertilizer, or a mixture of sulphur or sulphates with rock phosphates acts in the same way as superphosphates, the metallurgist should be able to meet the demand for such fertilizers in more than one way, with benefit to the mining industry and the farmer.

Development and Operation of a 50-Gram Flotation Machine

*Suitable for Rapid Work and Where Only Small Quantities of Pulp Are Available—
Results Compare Well With Those From Larger Machines*

By John F. Gates and L. K. Jacobsen

Research Fellows, Department of Metallurgical Research,
University of Utah

RESearch INVESTIGATION on the flotation of pure minerals and synthetic ores at the U. S. Bureau of Mines Intermountain Experiment Station, in co-operation with the Department of Metallurgical Research of the University of Utah, brought about the necessity for the development of a flotation machine of small capacity. All of the common laboratory types of flotation cells usually require from 500 to 1,000 grams of material for each experiment.

Five different machines were designed and built before the difficulties were overcome. In developing the machine, it was found that the same relative proportions for the spitzkasten and agitation chamber could not be used in the large and small machines. For a 50-gram machine the spitzkasten must be larger in proportion to the agitation chamber than in a 500-gram machine. The best ratio of agitating chamber to spitzkasten was finally determined to be 1.65 to 1. Careful control of speed was found to be more important than regulation of baffles. Small motors operating at very high speed (a malted-milk mixer making 10,000 r.p.m. was tried) or with added resistance in the field circuit will not give constant speed, and it was found that a lower-speed motor connected to the agitator shaft with belts and pulleys gives more constant characteristics. The present cell can handle a 50-gram charge with a pulp ratio of 4 to 1; by varying the size of the charge, the liquid to solid ratio can be easily changed.

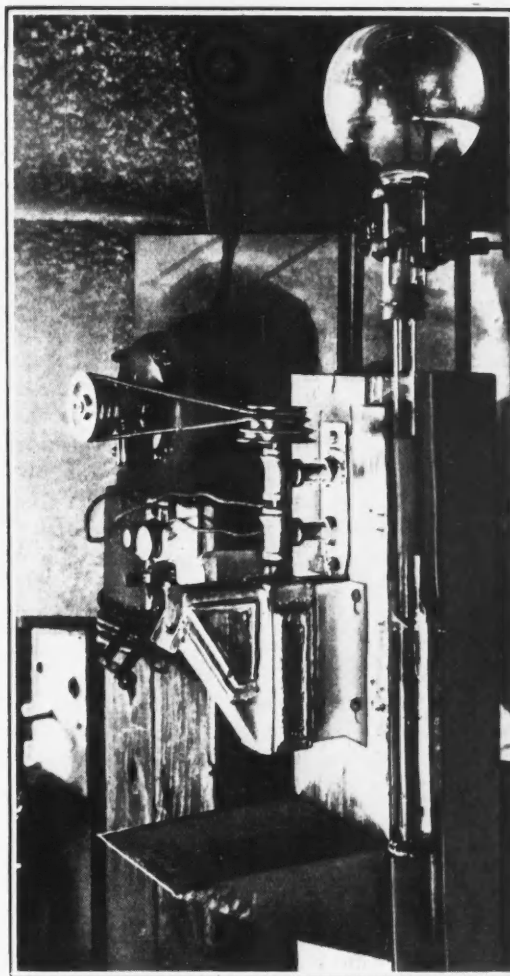
The cell is made of galvanized iron and is coated inside and outside with aluminum paint. The side walls are of glass, which permits conditions of agitation and frothing to be observed during operation. The cell is mounted on the side of an upright plank bolted to one of the built-in laboratory benches. The machine is held in place (see drawing) by screws in the plank which fit into slots in the back-support of the cell and hold it firmly in place, thus eliminating all vibration when operating. A shelf for holding a pan to catch the concentrate is attached to the upright in a similar manner. An advantage of these demountable features is the ease with which the machine may be cleaned.

The agitating chamber is $1\frac{1}{2}$ by $1\frac{1}{2}$ in.; the spitzkasten is $2\frac{3}{4}$ in. long at the top, 1 in. wide, and slopes from the lip to the bottom of the agitating chamber. The lip is $1\frac{1}{4}$ in. down from the top of the spitzkasten wall. Details may be obtained from the drawing.

The impeller shaft is a steel rod $\frac{1}{4}$ in. in diameter by $9\frac{3}{4}$ in. long, set accurately and rigidly in bearings, as shown in the sketch. The impellers are made of brass, with blades $\frac{1}{8}$ in. thick by $\frac{3}{8}$ in. long; the blades make an angle of 45 deg. with the vertical, the direction of rotation being such as to cause an upward movement of the pulp in the agitating chamber. The lower impeller clears the bottom of the cell by $\frac{1}{8}$ in.; the position of the other is determined by operating conditions and is usually about $\frac{1}{8}$ in. below the surface. Two impellers

were found to give sufficient agitation of the pulp. Speed of rotation is controlled by means of cone pulleys.

In the operation of a small machine the accuracy of results is largely a matter of using care in the manipulation. A gram lost in cleaning out after a run, or two



The machine ready for operation

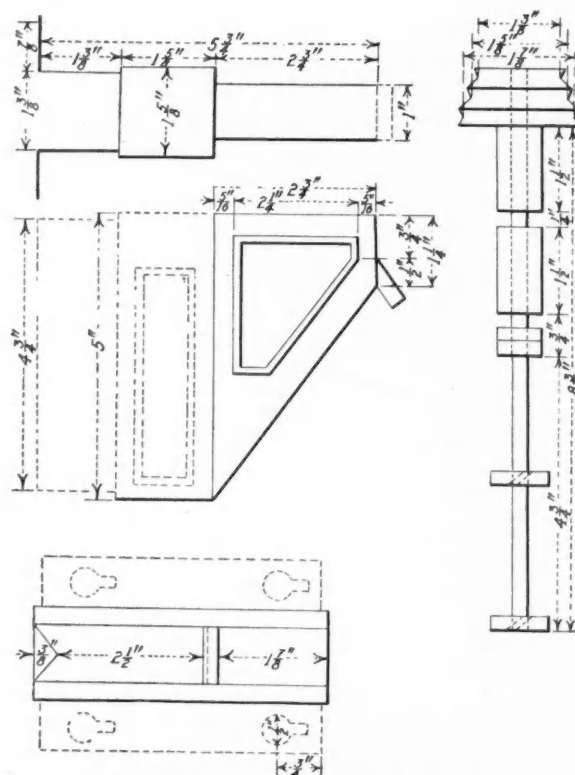
grams or so of pulp swept over into the concentrate while skimming, may mean a 2 per cent error in the case of a 50-gram charge, whereas it would be an error of only 0.2 per cent in a 500-gram machine.

To eliminate the unknown variable introduced into laboratory flotation experiments by hand skimming, a scheme for carrying the froth over the lip without assistance from the operator has been added to the machine. The height of water in the cell is held constant by a glass-tube siphon connection, one end of which dips into a small glass cylinder containing water, and the other into a corner of the agitating chamber. Water carried over the lip in the froth is immediately

replaced by that siphoned into the cell from the glass cylinder. This cylinder receives its water supply from an inverted liter flask from which runs a glass tube whose lower end dips into the cylinder. The end of this tube is adjusted to the height at which it is desired to maintain the water level in the flotation cell. Atmospheric pressure prevents the liquid in the flask from running into the cylinder; but as quickly as the level in the cylinder is lowered by a flow through the siphon into the cell, the end of the connecting tube is uncovered and water flows out until the lower end of the tube is again beneath the surface, and thus the level in the cylinder and consequently in the cell is kept always the same. When the apparatus is properly adjusted, there is no overflow of water at the lip; it is only the water carried over in the froth that is discharged, this being replaced at once by siphon action.

An inherent difficulty in the operation of any small-charge machine is the accurate measurement of the flotation oils and some reagents. In many instances, as with copper sulphate, a standard solution may be made and the desired amount measured out in a Mohr pipette. Oils, however, present a more difficult problem, although there are solvents for many of our flotation oils (as carbon disulphide, ether, and chloroform.) The use of such solutions, however, might affect the flotative action of the oil, so it would be difficult to correlate the results with those obtained by the use of oil in its normal form. At first the oils were made up in emulsions and small quantities obtained by measuring out the emulsions in a Mohr pipette; there was, however, always a little froth collected on the surface and hence the portion of liquid withdrawn in the pipette had not the oil content calculated, because there had been a concentration of oil at the surface. The difficulty of measurement has finally been overcome by feeding the oil onto a pin until a drop forms that will fall of its own weight. By this means quantities as small as 0.00435 gm. of pine oil can be obtained. This, with a 50-gram charge, is equivalent to 0.174 lb. of oil per ton of ore. To facilitate handling, the pins are sealed into the end of a piece of glass tubing. All of the oils used are carefully standardized as to the weight of a drop falling freely from the point.

The sample is crushed in the usual manner to the desired fineness and all metallic iron removed by a magnet. Fifty grams of this sample with 50 c.c. of distilled



Detail drawing of a 50-gram flotation cell

the stand under the lip to catch the concentrate. The time necessary for the sulphides to be completely floated varies with different minerals, but from six to ten minutes will usually suffice.

The machine is removed, carefully cleaned, and the concentrate and the tailing are filtered; hydrogen ion (*pH*) and surface-tension measurements are made on the filtrates. A DuNouy surface-tension machine is used for surface-tension measurements; *pH* values are determined by a series of hydrogen ion indicators and buffer solutions. By the time the cell is charged again and the *pH* values and surface-tension determinations are made, the pulp and concentrate have been filtered and are placed on the hot plate for drying. At the conclusion of the second experiment, the concentrate and tailing of the first experiment have dried and are weighed.

It is believed that the present 50-gram machine can be applied to preliminary flotation experiments with

Results on a Lead-zinc-iron Ore With 50-Gram Machine

	Weight, Grams	Per Cent, Total	Assays				Per Cent of Total			
			Pb	Zn	Fe	"Insol."	Pb	Zn	Fe	"Insol."
Feed.....	40	100	9.86	10.02	20.24	29.18				
Lead concentrate X3.....	7	17.60	52.02	2.35	11.41	6.51	93.00	4.14	9.90	3.90
Zinc concentrate X3.....	9.50	23.80	0.10	35.6	26.19	9.74	4.25	83.16	31.00	7.90
Tailing X3.....	23.30	58.50		2.2	20.02	44.26		12.7	58.00	88.60
							97.25	100.00	98.90	100.40

Comparative Results With 500-Gram Machine

	Weight, Grams	Per Cent, Total	Assays				Per Cent of Total			
			Pb	Zn	Fe	"Insol."	Pb	Zn	Fe	"Insol."
Feed.....	500.00	100.0	9.86	10.02	20.24	29.18				
Lead concentrate.....	67.50	13.70	68.90	1.90	6.47	2.48	95.50	2.60	4.40	1.15
Zinc concentrate.....	121.80	24.70	0.10	36.50	19.63	2.92	2.50	90.00	24.00	2.48
Tailing.....	304.30	61.80		1.20	23.02	44.84		7.40	71.00	95.00
							98.00	100.00	99.40	98.63

water are placed in a small Abbe mill without pebbles and agitated on rolls for fifteen minutes to insure complete wetting and to remove any oxidized surfaces on the mineral. The charge is then washed into the machine with as little water as possible and diluted to the desired pulp density. Oil is added to the agitating chamber, and the siphon connection of the constant water level device is made. A small pan is placed on

considerable advantage. A complete experiment can be run in fifteen minutes, thirty experiments can be made in a single day, and results reasonably comparable with a 500- or 1,000-gram machine are obtained. The simplicity of installation, moderate cost, and the rapidity with which experiments can be made suggest the employment of machines of this type for lecture-room demonstrations and ore-dressing laboratories.

Discussion

Senate Commission of Gold and Silver Inquiry

THE EDITOR:

Sir—In your issue of Feb. 21, 1925, a statement was made which suggested the possibility of misuse of the confidential information in the hands of the U. S. Senate Commission of Gold and Silver Inquiry.

Such rumors came to the attention of the American Mining Congress and were promptly investigated, with results which are embodied in the accompanying letter written to Captain H. A. C. Jenison, the engineer in charge of the work.

In view of the fact that such rumors still seem to be in circulation, I trust you will give this, and the attached letter, the proper publicity in *Mining Journal-Press*.

J. F. CALLBREATH,

Washington, D. C.

Secretary.

"Capt. H. A. C. Jenison,
"Senate Commission of Gold and Silver Inquiry,
"Senate Office Building,
"Washington, D. C.

"Feb. 26, 1925.

"My dear Captain Jenison:

"I am taking this opportunity to inform you that during a recent absence from your office a certain officer of the Internal Revenue was observed in your office. In view of the confidential nature of the work which you are undertaking, and thinking this circumstance might lead to justified criticism, we felt it the duty of this organization to inform one or more of our principal officers of this, together with our fear that some possible misuse of confidential information might take place.

"Having gone over this matter fully with you, we are convinced that no misuse of confidential information has taken place. We are taking this opportunity to regret that any such situation may have arisen and that you were not directly advised of the occurrence and to assure you that we have the highest feeling of confidence and regard for you and your assistants.

"Very truly yours,
(signed) "J. F. CALLBREATH,
Secretary."

Shipper vs. Smelter

THE EDITOR:

Sir—There is a certain type of lead smelter schedule now in use in parts of the West under which the treatment charge increases with the value of the ore. One of them will read something like this:

"Treatment charge \$4 per ton on ore of a gross value up to \$8, \$4.50 on ore of a value from \$8 to \$10. Add to treatment charge 10 per cent of the excess of value over \$10 up to a maximum charge of \$8."

There will also be a provision that when the price of lead exceeds a certain figure a percentage of the excess above this figure shall be deducted from the price paid for the metal.

By what process of reasoning should a treatment charge increase with the grade of an ore? Consider two tons of ore carrying 20 per cent lead as against one ton carrying 40 per cent. The two tons first mentioned contain the same amount of lead as the one ton of 40 per cent ore contains, and both must be smelted to

yield the same amount of metal. In all probability, because of their leanness, it costs more than twice as much to get this same amount of metal from two tons of 20 per cent ore as it does from one ton of 40 per cent ore. And yet by this form of ore schedule the charge per ton is greater for the smelting of the rich ore than for the lean.

If you ask the smelting company why this is done, its representative will tell you that, since you are making more money due to a better grade of ore or higher market, you should not object to the higher charges, for you are now so well able to bear them, and he endeavors to make you feel that you are a very unreasonable and selfish person indeed to question the company's right to share in your good fortune. And Mr. Average Shipper goes merrily on his way, thinking what a lucky devil he is after all to have a good grade of ore or a high market.

But is there any logical reason why the smelting company is entitled to participate in the miner's temporary prosperity? It is the miner's money and effort which have brought it about, whereas the smelter's contribution to it is exactly nil. Does the miller deduct because he buys the farmer's wheat on a high market? Does the packer make a charge because the cattleman's beef is of extra fine quality? I doubt whether any other important business in the country buys on any such basis.

If the practice is not illogical, then it should work both ways, and I suggest the following clause to be added to the schedule:

"Whenever the earnings of The Creamskimmer Smelting Co. for any calendar year shall exceed 4 per cent on its common stock, one-fourth of the excess above 4 per cent and up to 6 per cent shall be prorated among its shippers, each participating in said earnings in proportion to the value of the ore bought from him during said year. If, by reason of high metal markets or better grade of ore treated, the earnings of said smelting company shall exceed 6 per cent, one-half the excess above 6 per cent shall be prorated as above."

Whitepine, Col.

SHIPPER.

Hydrocarbon Veindikes and Oil Shales

THE EDITOR:

Sir—Mr. Hixon's hypothesis (suggested in your issue of April 18) that the gilsonite veins of northeast Utah are "the probable sources of eruption of the petroleum in the oil shales" is interesting, but does not seem to agree with the facts. The gilsonite veins are largely, perhaps mostly, contained in strata which overlie the Green River formation which contains the oil shales. It is emphatically not correct to say that "the series in which the veindikes of hydrocarbons occur" is "much older and a lower geological horizon than the oil shales."

I wish we could all get out of the habit of basing our conclusions on second-hand observation.

Denver, Colo.

GEORGE E. COLLINS.

News of the Week

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

Summary

PURCHASE of the control of the Utah Copper Co. by the Kennecott Copper Corporation did not violate the Clayton Act, according to a three-to-two decision by the Federal Trade Commission, brought to public attention through filing of the minority report.

Zinc concentrate from the Star mine, at Burke, Idaho, will be shipped to Belgium pending a decision as to the erection of an electrolytic plant at Kellogg.

An offer to purchase control of the Premier Gold Mining Co., of British Columbia, has been made by the Selukwe interests of London, which control the B. C. Silver mines.

After a sensational fight against fire, fourteen miners escaped unharmed from the Hecla mine at Burke, Idaho.

Satisfactory progress is reported in the negotiations looking to the merger of asbestos interests in Quebec.

Officials of the United Verde Extension Mining Co. deny current reports alleging bad conditions in the mine at Jerome, Ariz.

Lead mining is gaining in importance in the Argentine Republic, according to a correspondent from Buenos Aires.

Wages of miners in the Coeur d'Alene district, in Idaho, have been cut 50c. per shift as a consequence of the decline in price of lead.

American and British interests have obtained an immense concession in the Lena River region from the Soviet government.

Suspension of operations by the Guanajuato Reduction & Mines Co., employing several thousand men, has been ordered for May 18. The state government has started an investigation of the situation.

Star Zinc Concentrate Will Go To Belgian Smelter

Bunker Hill and Hecla Companies Make Contract Pending Decision on Erection of Plant at Kellogg

Zinc concentrate from the ore produced from the Star mine, in the Coeur d'Alene district in Idaho, by the Sullivan Mining Co., will be shipped to Belgium, according to a contract recently closed with the Vielle-Montagne Zinc Co., of Chenee, Liège, Belgium. The mine is owned jointly by the Bunker Hill & Sullivan and Hecla companies, and has only recently begun production after the completion of a long crosscut from the Hecla shaft. The Anaconda Copper Mining Co. was an unsuccessful bidder for the concentrate which it might treat at its Great Falls plant.

Negotiations for shipment abroad were conducted by Frank M. Smith, representing the Bunker Hill & Sullivan and Hecla companies, M. Chaplain and T. Nivette, direct representatives of the smelter, and Herbert Salinger, of Du Val Moore & Co., San Francisco, Calif., who are agents for the Vielle Montagne company in the western part of the United States.

Shipments will be started when the new railroad rate becomes effective, May 18. The quantity will be increased gradually as development of ore advances in the Star, but three or four months will elapse before ore is moving in an important volume. The concentrating of Star ore has been proceeding in the South mill of the Bunker Hill company at Kellogg.

The arrangement, it is understood, does not necessarily mean that the

Mexican Government Would Avert Shutdown of G. R. & M. Co.

AN ORDER has been issued by A. H. P. Smith, manager of the Guanajuato Reduction Mines Co., to suspend all operations of that company at Guanajuato, Mexico, effective May 18. In explanation of this action it is stated by Mr. Smith that for some time the company has been mining low-grade ore and that all efforts to bring to light ore of greater richness have proved futile. It was finally decided to cease operations for an indefinite period. The fact that the Guanajuato Reduction & Mines Co. operates a number of the largest properties in this district, employing thousands of men, makes the closing down of its properties of serious economic moment. An investigation of the situation has been ordered by the state government with a view of discovering some means of having the company continue its operations.

Bunker Hill company has abandoned its plans to build an electrolytic zinc plant. It merely provides a way to take care of the zinc product of the Star mine pending a decision to proceed with the construction of a zinc plant at Kellogg.

Ore is being hauled from the Star drift at the rate of 100 tons a day. It is provided by the development, which consists of a drift run 700 to 800 ft. Additional sources will be provided as levels are opened above the Star drift.

Selukwe Reported To Be Seeking Control of Premier

First-named Company Now Owns Many Claims in Portland Canal Region—Economy of Operation Objective

A. B. Trites, one of the principal shareholders in the Premier Gold Mining Co., operating at the head of the Portland Canal, in British Columbia, is authority for the statement that the Selukwe Gold Mining & Finance Co., of London, has been making overtures for the purchase of the Premier mine, though, so far as he knows, nothing definite has been arranged. The Selukwe company is the holding company for B. C. Silver Mines, which owns a considerable number of claims to the north and south of the Premier property and directly in line with the trend of the main vein system. B. C. Silver has done a considerable amount of exploration on the northern extension of the Premier main vein and has shipped more than 50 tons of ore. The two properties are connected by underground workings.

B. C. Silver has as yet no mill and no transportation system other than the main road, which in places is none too good. Unquestionably, the two properties could be worked more economically under one management. Some years ago, before B. C. Silver opened the main Premier vein on its property, the Premier company, which owns approximately one-third of the outstanding stock in B. C. Silver, offered the Selukwe company \$1,000,000 for the remaining two-thirds of the stock—an offer that the Selukwe company refused to entertain seriously at that time.

Crystal Copper Sinks Goldsmith Shaft to 850 Level

The Crystal Copper Co. has finished sinking the shaft at the Goldsmith mine, in Butte, to the 850 level, and will drive crosscuts to the new properties acquired some time ago. If mine developments warrant, the shaft will be sunk to the 1,000 level. Except for development work, the mine is operated by the leasing system.

Montana's Metal Production for Taxation \$38,000,000 in 1924

Montana will receive between \$380,000 and \$385,000 this year as taxes on metal mines, as shown by the metal-mines gross-proceeds tax that has just been estimated after seven of the largest mining companies had filed their return for the year 1924. They showed a total metal production of \$38,000,000.

A notation was made on the returns by the larger companies that the right to pay the taxes under protest is reserved.

Plan Custom Plant to Treat Inyo County Silver Ores

The Continental Development & Reduction Corporation, of Los Angeles, of which J. S. Tremayne is president and general manager, has purchased the plant of the Chemicals Refining Co., which is near Owens Lake, in Inyo County, Calif., and with some changes and the addition of crushing units, has remodeled it to treat silver-lead ores. The mill will have an initial capacity of 200 tons of ore daily, and is expected to be ready to start about May 15.

It is the plan of the company to handle custom ores, and especially the product of the Acme Mining Co., which has holdings near Darwin. This company, it is stated, has 15,000 tons of ore broken ready for the mill, and 100,000 tons blocked out in the mine, that is said to average \$25 to the ton.

Quincy Finds Marked Advantage in Angular Grinding Media

For several months, the Quincy Mining Co. at its stamp mills on Torch Lake, in the Michigan copper district, has experimented with different grinding mediums in its ball mills. It was found that short pieces of old drill steel—in fact, any pieces of small iron mixed with the regular balls—tended to increase the capacity of the ball mills and decrease the copper losses in the tailings, as compared with results when iron or steel balls were used, the iron-copper ratio tending to betterment.

Cubes with sharp corners were tried out, and cubes with chamfered corners. Other variations were tried, and last the pentagonal dodecahedrons, which have been standardized and are now the regular grinding media in use in all the ball mills. These latter, by increasing the rock-iron ratio, have in turn decreased the power consumption. Furthermore, it was found that there was an increase in the copper saving by decreasing the copper lost in the tailings.

Fourteen Miners Quench Fire in Hecla Pump Station and Reach Safety

Serious Disaster in Coeur d'Alene Averted by Courageous Workers—Remarkable Escape

NINE BELLS! The emergency call for the cage from the 2,000 level of the famous Hecla mine at Burke, Idaho, at 3:22 Friday afternoon was the "sweetest danger signal" that ever sounded in the ears of the crowd of miners and townspeople who waited at the collar of the shaft. Shortly after, the cage brought to the top safe and sound fourteen miners who had been trapped for fifteen hours by a fire in the pump station on the 2,000 level. So hot had been the shaft between the 1,600 and 2,000 levels that would-be rescuers on top had been unable to reach the fire zone. But with a resourcefulness and courage that seldom have been equaled, the miners themselves, under the leadership of H. R. Uhtoff, obtained an old sinking pump, hooked it up to the compressed air line amid clouds of deadly smoke near enough to the fire to be effective, and drawing water from the ditch along the crosscut slowly but surely overcame the blaze that stood between them and life itself.

Uhtoff, an "old-timer," is generally hailed as the "best miner" in the Coeur d'Alene, now, and that means much in a district that is noted for its splendid underground men. Among the things that make a good miner is the ability to keep his head in time of danger, the courage to face possible death but to fight hardest to avert it when it seems closest at hand. These are the qualities that Uhtoff and his companions displayed; and it is for these reasons that Uhtoff is a hero in the Coeur d'Alene today.

The fire started shortly before midnight of April 24 in the pumping plant at the base of the main shaft on the 2,000 level. The pumpman on duty left his station, it is stated, and when he returned about ten minutes later he found the plant afire.

Three men rescued from the 1,600

level, Vern Llewellyn, B. Van Voorhis, and R. C. Richardson, were partly overcome by smoke and gas, but soon were revived.

Of the forty men in the mine when the fire broke out, all but seventeen were led to safety by K. J. Kelly, the pumpman, who discovered the fire, in the pump station on the 2,000 level.

Another hero was B. Van Voorhis, one of the three men rescued from the mine before the fumes forced the rescue crews, under the direction of Karl T. Sparks, in charge of mine rescue for the district, to retreat. Van Voorhis, a youthful miner, was credited with having refused to permit R. C. Richardson, a fifty-one-year-old companion, to "remain there and die," as he put it. When the older man would have surrendered in the face of the long climb to safety, Van Voorhis dragged him to a point in the drift in which they were working to a point about a mile and a quarter from the shaft.

Half smothered by the clouds of smoke, they lay on their faces at the end of the tunnel for a while and then when Richardson had collapsed completely, his companion piled him on the motor of an ore train and turned it on full speed. When Van Voorhis recovered consciousness a doctor was bending over him on the surface. His motor had been wrecked somewhere down the drift, he said, and he had been taken to the surface by rescue crews.

When the ordeal of watching and waiting by the families and friends of the trapped men was over there took place a demonstration such as only a mining camp can stage.

As Uhtoff, leader of the trapped men in their operations against the blaze, walked out of the big mine building, a friend shouted:

"Hey, Herb! Your wife told me to tell you that as soon as you got out to buy some bread and come home!"

Produce Tungsten Ore Regularly Near Mina, Nev.

The American Tungsten Co., which has a working bond on the Summerfield tungsten property, about 20 miles easterly from Mina, Nev., is putting in additional machinery preparatory to an increase in the scale of operations. At present the company is operating a Stebbins dry concentrator with success, and producing 700 lb. of high-grade scheelite concentrate per day.

The lime-granite contact streak of high-grade ore first opened in February is developing satisfactorily, and to date drifts have been driven 40 ft. on the ore.

Recent visitors to the property included John A. Reigert, formerly mine superintendent of the United Comstock at Virginia City, now in charge of mining operations for the Ford Motor Co., and George W. Sargent, president of the Molybdenum Corporation of America.

Silversmith Makes Another Disbursement

Silversmith Mines has disbursed a dividend of \$25,000, covering operations for the first three months of this year. This brings the total disbursement up to \$525,000. Curiously, like the Premier Gold Mining Co., Silversmith has returned to its shareholders 140 per cent of their investment.

Most of the ore has been obtained from the 800, 900 and 1,100 levels on the new Silversmith shoot, in which there still is said to be three years' ore reserve at the present output of the mine. Development from the 1,000 level on the Slocan Star shoot has opened a 4-ft. body of milling ore over a length of 65 ft. at 1,100 ft. At the 1,000 level the shoot was only 6 in. wide and 12 ft. long. The winze is expected to reach the 1,200 level within a few days, and there a station will be cut and levels driven in both directions.

U.V.X. Officials Deny Stories of Unfavorable Mine Conditions

No Troubles; No Fires; No Ground Movement—Costs of Production Low

Directors of the United Verde Extension Mining Co., operating in the Jerome district in Arizona, have issued a statement to shareholders which says in part:

"For some time your company's property has been the subject of attacks emanating from various irresponsible, unreliable sources. Your directors and officers have been fully aware of these unwarranted reports, but ignored them in the belief that, being so manifestly without foundation, they were unworthy of denial. Recently attacks of this sort have become more insistent and vicious and have caused uneasiness among our stockholders.

"It has not been the policy of this company to deny unfounded and irresponsible rumors sent out for ulterior purposes. We believe, however, the absolutely untrue statements recently made should be answered. There is no truth whatever in these statements, which are herewith denied.

"The facts are that the general condition of the mine is excellent. There has been no mining trouble underground of any kind whatsoever. No movement in the ground has taken place. There is no danger of fire. Our costs are low and production is satisfactory. There is no reason whatever for fear or apprehension on the part of our stockholders. A regular quarterly dividend has been declared payable May 1.

"We ask our stockholders to depend on the information contained in the company's reports. It has been and will be the policy of this company at all times to keep the stockholders in touch with the real facts."

Owners of Riverside Mine May Extend Operations

The Riverside mine, situated seven miles up the Salmon River valley from Hyder, Alaska, has been closed, pending, it is stated locally, the formation of a company, with a view to acquiring a number of surrounding properties. The mine is owned by Messrs. Barber, Black, Littlepage, and Strong, who developed it for three years before erecting a mill. The mill was put into operation early in this year, and since has been crushing 60 tons of ore per day and turning out 12 to 15 tons of concentrate, which is said to average around 9 oz. in gold and 60 oz. in silver per ton and 70 per cent of lead.

C. & A. Will Try McGregor's New Pyritic Smelting

The Calumet & Arizona Mining Co. has entered into an agreement with A. G. McGregor, consulting metallurgical engineer, for the testing of a new method of pyritic smelting which the latter has evolved. The mining company plans to erect an experimental furnace, for use in making the tests, at its smelter in Douglas, Ariz.

Simon Silver-Lead Mills 150 Tons Per Day

The Simon Silver-Lead Mines Co. is operating its selective flotation plant in the Simon district north of Mina, Nev., continuously, treating 150 tons of ore per day, and producing at the rate of 600 tons of lead-silver concentrate and 450 tons of zinc-silver concentrate per month.

Development and stoping are said to have disclosed new orebodies and important extensions of the old ones, and a large reserve of mill ore is available between the 400 and 700 levels.

Florence Silver Mining Co. Reorganized

The Florence Consolidated Mining Co. has been organized under the laws of Idaho, with an authorized capital of 3,000,000 shares, par value \$1 per share. D. W. Shanks is president and manager. The company is taking over the assets of the Florence Silver Mining Co., and will assume its liabilities. It hopes to raise sufficient money to satisfy the pressing creditors and to put the mine and mill at Ainsworth, B. C., in operation.

Champion Makes Good Strike

A recent report from the Champion mine, situated near Deer Lodge, Mont., is that a 5-ft. vein of high-grade silver ore has been found on the 700 level. The oreshoot has been opened up for a distance of 100 ft. and shows good values all of that distance. It is said that the vein averages 40 oz. silver per ton.

Sonora Placer Claims Optioned

The placer claims of the Cherokee Mines, Consolidated, near Sonora, Tuolumne County, Calif., have been optioned to T. L. Brophy and his associates, of San Francisco, for \$100,000, the first payment of which, amounting to \$5,500, was made on March 1, 1925. Payments are to be spread over a period of eight years. The property comprises 350 acres of placer ground.

Values U. V. X. Holdings at More Than \$30,000,000

C. H. Dunning, of Prescott, Ariz., a mining engineer employed by the Yavapai County Board of Supervisors to value the holdings of the United Verde Extension Mining Co. for tax purposes, sustains the figures of the state tax commission and places a valuation on the property of more than \$30,000,000. He declares that the ore exposed has at least \$700,000 more net value than that which was in sight early in 1922. The company protested the valuation and claims it is over-taxed.

Idaho-Maryland May Shut Down

Rumors current in San Francisco to the effect that the Idaho-Maryland mine, at Grass Valley, Calif., was to be shut down have not been confirmed by the Metals Exploration Co. No statement of policy is forthcoming.

Hamilton, Nev., to Be Prospected Again for Ore

Will Diamond-Drill Old Treasure Hill Properties—Recent Attempts at Rehabilitation Failed

Exploration and prospecting will soon be resumed in the Hamilton, Nev., district, on and in the vicinity of Treasure Hill. This well-known, early-day producer of high-grade silver ore has been worked at various times during the last several years without pronounced success. The worked-out orebodies were large chambers in limestone, and it has been the hope of finding similar ones which has encouraged the expenditure of money, time, and effort in this district.

The principal part of the old producing section is controlled by the Treasure Hill Mining & Milling Co., which is controlled by Ira B. Joralemon and H. T. Hamilton, of San Francisco, and it is now reported that churn-drill prospecting is to be resorted to this summer. All large orebodies thus far discovered have been near the surface and were of considerable lateral extent, so that prospecting by drilling may accomplish what regular development and mining has failed to do.

Several smaller companies are preparing to resume or begin work on adjacent properties. These include the Aladdin Divide, Divide Extension, Myra Divide, and others.

Asbestos Corporation Favors Merger, but on Its Own Terms

The Asbestos Corporation of Canada is sympathetic to the proposed merger of the various companies in the Quebec asbestos fields, but will not enter the consolidation until it feels confident that the plan assures ultimate success. This is the gist of the remarks made by W. G. Ross, president, at the annual meeting. According to Mr. Ross, there were a few features of the merger which had not yet met with the approval of the directors. He stated that the plan was to give the bondholders of his corporation the privilege of exchanging their holdings into the new 6 per cent bonds of the new company. The present preferred stock of the corporation, which is 6 per cent participating, would be exchanged for 7 per cent cumulative preferred stock of the new venture, and the present common stock would be exchanged into 6 per cent second-preferred shares of the new organization. Each share of the last-named stock would also receive a bonus of one new share.

Mr. Ross said that the interests behind the merger were investigating the prospects of paying dividends on all the stock issued, together with the bonus common shares. It is reported from Montreal that the Maple Leaf Asbestos Co., another Quebec producer, has agreed to go into the merger on the terms offered the company by Dillon, Read & Co., the firm which is trying to consolidate the numerous Quebec asbestos corporations. Latest reports are that an agreement has been virtually reached between all of the interests involved.

Bingo Shareholders Endorse Myers, Despite Fraud Charges

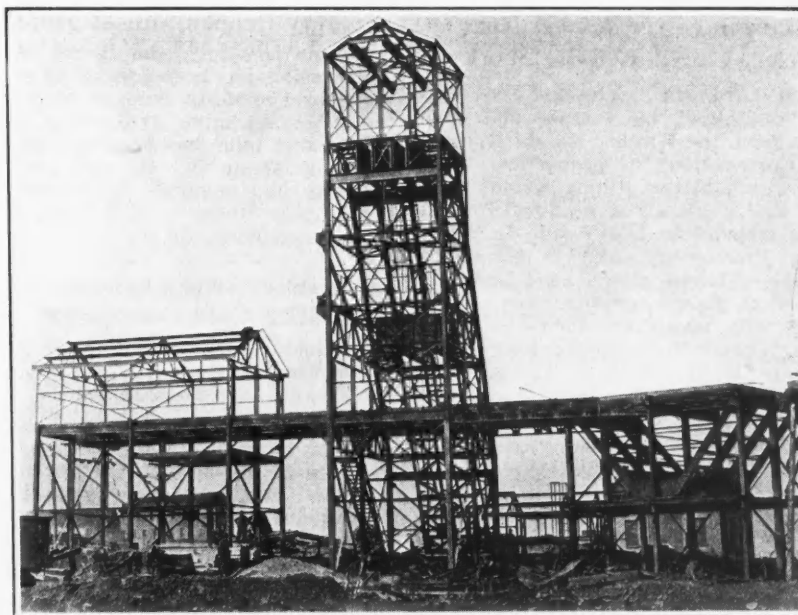
Re-elect Him Director — Evidence Regarding Sampling Indicates Irregularities

At the annual meeting of the Bingo Gold Mines, Ltd., owning property in the Herb Lake district in Manitoba, held in Winnipeg on April 27, the shareholders, after hearing a long statement from Joseph Myers, manager of the mine, rejected the report of the directors, elected a new board and passed a recommendation that the board should proceed to liquidate the assets of the company and distribute them among the shareholders.

Myers, who is undergoing a preliminary hearing in the city Police Court on charges of making false statements with intent to defraud in connection with the sale of shares in the company, resigned as a director, and was re-elected. He is the only member of the old board to be re-elected. Myers denied that he had, as had been reported, disposed of any of his holdings of Bingo stock. He detailed the attempts made to finance the company, and said he had personally incurred obligations of \$100,000. He declared there was a lack of harmony among the directors of the company. He charged the samples taken while he was thousands of miles away from the mine had shown higher assays than the samples taken when he was in Winnipeg. In the event of the failure of the mine, he would, he said, be the heaviest loser.

Microscope Showed Gold Flakes to Have Been Filed

At the preliminary hearing of Myers Prof. R. C. Wallace, of Manitoba University, produced photographs and slides showing the material taken from sample sacks, and swept up in the blacksmith shop of the Bingo mine, showing flakes of gold. He explained the difference in appearance between gold naturally crushed from the ore and gold filings, which he demonstrated in court by means of a microscope. Natural gold, said Dr. Wallace, had a rough surface, had no parallel marks running across it and did not show the shiny appearance of filed gold. Material taken from an overall hip-pocket, from a book-cover which had been made from a sample sack, and flakes found in two sample sacks stated to have been found in Myers' trunk, were all pronounced by Dr. Wallace to be unnatural gold. Two of the bags said to have been taken from Myers' trunk had not been examined, and at the request of R. A. Bonnar, counsel for the defence, Dr. Wallace examined one of them in court, finding a flake which he positively declared was not gold in its natural state. He further stated that in his examination of the pulp from assay samples assayed by Milton Hersey he had picked out eight pieces of gold of unnatural shape, which he produced in court mounted on a slide. In his opinion they were made by a file or some similar tool, and he did not think that the grinding of the pulp could possibly produce such results.



New surface plant at Newport iron mine

Headframe and pockets which the American Bridge Co. have erected for Pickands, Mather & Co. at "K" shaft of the Newport mine, at Ironwood, Mich. This steel headframe replaces a wooden one recently torn down. The engine house is located to the side of the shaft and the ropes pass over idler sheaves, the foundations for which are now being put in. The hoists are operated by steam which is piped from the central power station at the Woodbury shaft. "K" shaft is one of the deepest shafts on the range, and contains the pumping plant for the entire Newport mine.

Lower Lead Price Cuts Miners Wages in Idaho

Following a decline in price of lead to 7.85c. per pound, producing mining companies of the Coeur d'Alene district, in Idaho, have posted notices of a reduction of 50c. a day in wages, effective May 1. The new daily wage scale will be as follows:

Muckers, \$5; miners, \$5.50; carmen, \$5; timbermen, \$6; timber helpers, \$5.25; hoistmen (small hoists), \$5.75; surface laborers, \$4.75; blacksmith, \$6.25; nippers, \$5.25; cagers, \$5.75; pumpmen and compressor men, \$5.75; machinists, \$6.25; motormen, \$5.25; shift bosses, \$6.75; pipe-track men, \$5.75; electricians, \$5.75; millmen, \$5.25; mill repairmen, \$6.25; carpenters, \$6.25; ore sorters, \$4.75.

The producing companies determine wages with a sliding scale based on the price of lead.

Rake Classifiers Displace Log Washers in Some Plants

Operators of several washing plants along the Mesabi range, in Minnesota, have discarded their 18-ft. log washers and tables and installed Dorr rake classifiers. One unit of the five-unit Trout Lake plant of the Oliver Iron Mining Co. at Coleraine has been changed over, and two classifiers have been installed in the two-unit plant of the Wisconsin Steel Co. at Nashwauk. The M. A. Hanna Co. has placed a classifier in the Crosby washing plant, which it now uses, and the Leonidas concentrator of the Oliver Iron Mining Co. at Eveleth has been equipped with one classifier. The other plants are holding off until they make more extensive experiments to prove the economy of these classifiers.

Tonopah Premier Will Explore

The Tonopah Premier Mining Co., a new incorporation, has taken over a large group of claims in the northeastern part of the Tonopah district, and representatives of the company state that they are prepared to sink 1,200 ft. and crosscut at least 3,000 ft. This property joins the Mizpah Extension on the north, and the new work will be started about 2,000 ft. north and 3,000 ft. east of the Mizpah Extension shaft. The fact that the surface is covered by later formations which are not ore bearing is not fatal in the Tonopah district, as there is less than one-tenth of one square mile of surface in which vein outcrops are found.

Four Strong Companies Mine Gypsum in California and Nevada

The Blue Diamond Co., of Los Angeles, Calif., recently acquired a gypsum deposit in the Spring Mountain district west of Las Vegas, Nev. It is planned to exploit the deposit, and surveys have been made for a branch line to the Union Pacific R.R. A wire-rope tram is planned to connect with the railroad.

The U. S. Gypsum Co. is now operating a deposit at Arden, Nev., in the same district. The Pacific Portland Cement Co. recently started mining at Gerlach, Nev., and is also exploiting a gypsum deposit at Plaster City, Imperial County, Calif. The Standard Gypsum Co. of San Francisco operates a quarry and calcining plant at Ludwig, Nev., and has recently acquired a large deposit on San Marcos Island, off Lower California. This makes four strong companies now mining gypsum in Nevada and California, the Pacific Portland, the U. S. Gypsum, the Standard, and the Blue Diamond.

Darwin Silver Mines, Near Keeler, Calif., Will Be Worked

C. H. Lord, of Chicago, and associates have purchased, on a lease and bond basis, from the Wagner Assets Realization Corporation, the properties of the old Darwin Silver Mining Co. at Darwin, Calif., 25 miles east of Keeler. These include the Lucky Jim, Defiance, Lane, Promontory, and Independence lead-silver mines, which have been developed to depths varying from 150 to 960 ft. and which are accredited with a past production approaching \$10,000,000. H. E. Olund, a mining engineer of Los Angeles, has been placed in charge of the properties.

Operations are planned by the new owners, but a definite program of work will not be decided upon until the completion of radio-electrical surveys by the Radiore Co., of Los Angeles, which are being made under the supervision of Daniel G. Chilson, inventor of an instrument sponsored by the College of Mines and Engineering of the University of Arizona.

El Tiro Earned \$16,594 in First Quarter of 1925

The Western American Mines Co., operating El Tiro copper mines at Silverbell, Ariz., during the first quarter of 1925 produced copper for 12.82c. per pound, according to the following:

Dry tons produced and sold.....	8,083.91
Average copper content, per cent.....	6.61
Total copper produced, lb.....	1,070,640
Average selling price, cents.....	14.37
Gross value.....	\$153,947.01
Cost of smelting.....	\$60,406.57
Cost of freight.....	23,862.71
Cost of mining.....	53,082.97
Total costs.....	\$137,352.25
Cost per pound, cents.....	12.82
Available for dividends and royalties.....	\$16,594.76

New Crushing Plant at Hibbing Nears Completion

The Scranton mine of Pickands, Mather & Co., at Hibbing, Minn., has been shut down after loading out 10,000 tons, because of the chunky nature of the ore. Operations will not start again for six weeks or until the new crushing plant, which is under construction, is completed. The steel work is now being erected, and if material continues to come forward with no delays the plant should be in operation by June 10. The layout is similar to the crushing plant built at the Morris mine of the Oliver Iron Mining Co. several years ago.

Chloride Queen Finishing Mill

The Chloride Queen Mining Co., operating near Colville, Wash., is preparing to install machinery in its new building, and expects to be producing concentrates by July 1. The building was completed last fall. When the mill is completed the company will be in a position to start several stopes at different places and on different grades of ore so as to supply the mill with a mine run of having a value of at least \$20 a ton. A concentrate having a value of \$100 per ton will be made.

May Reopen Sunset Mine

A new company, the Sierra Metals Corporation, has been formed to reopen the Sunset mine, in the near vicinity of the Argonaut mine, at Jackson, Calif. The Sunset mine has been opened to a depth of about 400 ft., and the new company has engaged B. Sanguinetti, at one time foreman of the Argonaut, as superintendent of the new work.

British-American Interests Get Rich Gold Concession

Lena Goldfields Said to Contain \$150,000,000 Involved—Silver, Copper and Lead Ores Included

A fifty-year concession on 1,500,000 acres of territory in the Lena, Altai, and Sissert districts, with vast developed and partly developed deposits of gold, silver, copper, and lead, has been negotiated with the Soviet government of Russia on behalf of Lena Goldfields, Ltd., by Walter Lyman Brown, of Los Angeles, Calif., formerly European director of the American Relief Administration; Alexander Malozemoff, of Oakland, Calif., formerly chief engineer for the Lena company; and Major W. D. Gwynne, of London, according to authoritative reports.

Although Lena Goldfields is a British corporation it is understood that American interests will supply half of the capital and that American engineers will participate in the direction of the exploitation. It is said also that most of the machinery used in mining will come from America.

Estimates place the value of the reasonably assured production at \$150,000,000 with large potential additions to this figure.

Lena Goldfields, Ltd., will absorb the interests of the Russian Mining Corporation, Ltd., the Altai Mines, Ltd., and the Sissert company, which operated some of the mines covered by the present concession before the revolution.

The Lena gold field, which is a placer property, embraces about 150,000 acres and is estimated to produce from 50c. to \$1 worth of gold for every yard of gravel moved in dedging.

In the Altai district, which covers 13,000 square miles, there is declared to be 2,000,000 tons of ore with an average recoverable content of silver, copper and lead of \$50 a ton. The Sissert mines are expected to yield an average of \$100 worth of gold, silver, and copper per ton.

The Sissert area is rich in iron and timber, which the holders of the concession will exploit. In addition, coal mines in the Kuznetsk basin and anthracite mines in the Urals are to be worked by the company.

One American mining engineer in Siberia, Chester W. Purington, who was killed in the Japanese earthquake in 1923, considered the Lena Valley the world's richest undeveloped country. He dreamed of developing an Asiatic Klondike in northeast Asia, three times the size of Alaska, and in his opinion fabulously wealthier. Another American, Reuben Smith, who was drowned near Okotsk, Kamchatka, in 1919, was credited with having introduced methods in the Lena fields by which gold-bearing sands could be washed in winter as well as in summer.

Free-milling Gold Ore Cut by White Caps

A rich strike of free-milling gold ore has been made on the 1,120 level of the White Caps mine, at Manhattan, Nev. The ore where first cut shows a width of at least 8 ft., and a drift is out 30 ft. without change, the ore averaging \$60 per ton. The White Caps mine has previously had fairly large bodies of ore above the 800 level, but the complex nature of the ore, which contained both arsenical and antimonical compounds, made the reduction problem difficult, and no profits were made. The significance of the present strike is in the fact that arsenic and antimony are practically absent, making it a suitable ore for the company's 100-ton cyanide plant to handle.

The main shaft on this property is 1,350 ft. deep, and, as soon as working conditions will permit, drifts will be started on the 1,200 and deeper levels, to develop the oreshoot.

Michigan Copper Mines Lose Men to Automobile Centers

Most of the mines in the Michigan copper district are losing men to the farms and other forms of surface employment, and the labor turnover is larger than usual. Two of the mines report a net loss in underground forces. Young men continue to show a preference for work above ground, and many of them are leaving for the automotive centers. As a special inducement to young men, eighteen years or more of age, to remain in the district and learn mining, the Quincy Mining Co. has offered to employ them as machine runners, at good wages, placing them in charge of experienced miners for instruction in the best methods of mining. The more proficient, the company states, can earn large bonuses.

Katherine Gold Mining Co. Finishing Cyanide Plant

The Katherine Gold Mining Co., operating in the Kingman district, in Arizona, is completing the construction of a new 100-ton cyanide plant. The equipment includes a ball mill, Dorr tanks, and Merrill precipitating equipment. Power will be supplied by 450-hp. electric generator direct-connected to a Diesel oil-burning engine.

According to R. L. Dimmick, general superintendent, the operations of the Katherine company are not being financed by the Tom Reed Gold Mining Co., as was suggested in a recent issue of *Mining Journal-Press*.

Squaw Peak Company Will Ship

The Squaw Peak Mining Co. is preparing to resume operations on its property in Rock Canyon, about three miles northeast of Provo, Utah. It is reported that several cars of silver-lead ore are ready for shipment.

Development work on the property is planned by stockholders of the company as a result of favorable reports on the mine by a number of engineers and the uncovering of valuable ore in recent operations.

Lead Mining in Argentine Gains in Importance

Some Local Smelting, but Lead-Silver
Ores Go To Germany—Vanadium
and Antimony Shipped

By Mark R. Lamb
Mining Engineer, Buenos Aires

Buenos Aires, April 15—Lead mining is gaining in importance in Argentina and several small smelters are now in operation. The very high duty on fabricated lead makes it attractive, and the price obtainable for pig lead is good. So far the local smelters pay very little for silver content, so that the silver-lead ores are still shipped abroad, mainly to Germany. A small lead mine has been developed near Córdoba, and reverberatory smelting will begin soon. The mine is close to the railway, and it is intended to desilverize and make lead pipe and sheets, a little later. The New York Steel Exchange, Inc., has sold a complete small concentration plant for galena ores to one company.

H. A. Barker has recently reported on the mines of the Mendoza Gold Mines Co. Dr. Benito Villanueva has had a report on the silver-copper mines at Paramillo, with the result that a small syndicate has been formed to spend a few thousand dollars in search of the extensions of the old, rich, lost orebodies.

Famatina May Be Revived

The famous Famatina has been examined by an engineer in behalf of the Banco de la Nación, with a view of a further advance of funds by the latter to resuscitate the company. The mine and smelter have been closed for over a year.

Vanadium ores are being produced in small quantities in the Province of Córdoba. Antimony regulus is now being shipped in regular, small quantities from the north Argentine mining region. Bismuth ore has been found near the railway station of Alpasinche, but no shipments have been made. The recent drop of 50 per cent in the price of this metal has discouraged the holders of the claims.

Carlos W. Van Law, after spending several months and a considerable sum of money in examining a supposed gold mine for American interests, has stopped work, disbanded the crew, and returned to New York. The mine is owned by French interests, which insist that it is a good mine, and that they will continue to develop and operate the mine. However, anyone who knows Van Law would not be inclined to think that he has reported unfavorably on a good mine.

H. Foster Bain, after several months spent in examining the coal and iron resources of the Argentine, has just left for the United States, via Chile. From newspaper reports one gathers that Mr. Bain and his assistants have seen every reported cropping of iron or coal between Patagonia and Bolivia. None of his conclusions have been made public, though it is reported by one daily that Mr. Bain has left instruction as to work to be done in several places, and that he will return to the Argentine in six months.

News from Washington

By PAUL WOOTON
Special Correspondent

Kennecott's Buying of Utah Copper Did Not Lessen Competition

Three Trade Commissioners Refuse to Issue Complaint—Thompson
and Nugent Dissent and File Report

THE Federal Trade Commission has refused to issue a complaint against the Kennecott Copper Corporation, which was charged with having violated the Clayton Act in acquiring the stock of the Utah Copper Co. Two members of the commission dissented.

Despite newly issued rules regarding publicity, which provide that no publicity is to be given by the commission prior to the issuance of a complaint, Commissioner Houston Thompson insisted upon the publication of his minority report. Commissioner John F. Nugent concurred.

Since the majority of the commission found that no complaint should issue against the Kennecott Copper Corporation for its purchase of the stock of the Utah Copper Co., no statement was issued by the majority other than the announcement of their refusal to issue a complaint.

As this is written, it is fully expected that the Administration will take some action against Commissioner Thompson. In addition to violating the rule adopted by the commission, he also is accused of having violated Section 10 of the Trade Commission Act, which imposes penalties against any officer of the commission who is guilty of making public information without the authority of the commission.

Mr. Thompson was an Assistant Attorney General for five years during the Wilson Administration. Later he was appointed by President Wilson to be a member of the Federal Trade Commission. He frequently has drawn the fire of conservative officials. He was mentioned prominently as Senator La Follette's running mate prior to the last campaign.

In his dissenting opinion Mr. Thompson says in part:

"On the fifteenth day of April, 1925, Commissioners Van Fleet, Hunt, and Humphrey, a majority of the Federal Trade Commission, voted to dismiss the application for a complaint against the Kennecott Copper Corporation, which was charged with acquiring the stock of the Utah Copper Co., in violation of Sec. 7 of the Clayton Act. Sec. 7 forbids the purchase of stock 'where the effect of such acquisition may be to substantially lessen competition between the corporation whose stock is so acquired and the corporation making the acquisition, or to restrain such commerce in any section or community, or tend to create a monopoly of any line of commerce.' (Italics mine.)

"The majority voted not to issue a complaint. They have based their dismissal upon an opinion and recommendation of the chief counsel of the commission, who contends that the pur-

chase of the stock of the Utah company by the Kennecott corporation had 'not been used to bring about a substantial lessening of competition.'

"In the United States there are about twelve copper-selling agencies through which practically all copper produced on the American continent is sold. It is asserted by the Kennecott Corporation that these agencies compete with each other in the sale of copper. Companies selling through any agency may withdraw at any time and sell individually or through another agency. . . .

"The majority, adopting the language of the chief counsel of the Commission, says:

"There should be no straining of the law regarding elimination of possible competition or potential competition. Possible competition or potential competition may mean many things. If the section is construed to mean something that can be imagined or something that can be conjectured, then the statute would be invalid. Under such circumstances it does not require much to bring anybody into competition with somebody under some circumstances, if you are left free to conceive the circumstances. This in itself is sufficient to show that Congress never intended such an application of Sec. 7.

"The misapprehension indicated in this statement of the majority lies in the fact that there was both actual and potential competition destroyed through the consolidation of these companies. What there was of actual competition has already been referred to. The potential competition was ever present and probable. According to the Kennecott Corporation, the respective companies could have withdrawn from the same sales agency and become competitors for the business of the consuming public.

"If the position of the majority were carried to its logical conclusion, then, whenever any two or more companies, no matter how large, want to combine they can evade the provisions of the Sherman, the Clayton, and the Federal Trade Commission acts by joining a single selling agency. Having thus reduced the competition between each other, as heretofore described, one can then purchase the stock of the other and go scot-free, so far as the anti-trust laws are concerned.

"The majority have also adopted the following language of the chief counsel:

"The facts here show that the controlling purpose of the Kennecott Corporation, in acquiring control of the companies, was to extend its business and by increase of production protect itself in the way of an increase in net earnings for the stockholders and not to stifle competition or create a monopoly or control the market.

"The courts in interpreting the Clayton Act have stated clearly and without qualification that those administering or enforcing this act have nothing to do with the purpose or motive that may

have caused one company to absorb the other by purchase of its stock, but only with the effect.

"The case now before us was brought under the Clayton Act, which act was intended to supplement the Sherman Act and had for its purpose in this particular the giving of power to the commission to prevent the absorption of one competitor by another where the effect would be to substantially lessen competition between the acquiring and the acquired corporations, rather than wait for action on the part of the government under the Sherman Act when the monopoly had attained its full flower.

Examiners of the Commission Recommended Issuance of the Complaint

"The commission has functioned to the point where it has refused to issue a complaint against the Kennecott Corporation. Had such a complaint issued, the Kennecott Corporation would undoubtedly have filed its answer. Issue would then have been joined. Testimony would have been taken, witnesses examined and cross-examined, and the whole matter with all available information submitted to the commission for its decision. As the case now stands, the commission has made an investigation through its examining force, all of whom having to do with it have recommended the issuance of a complaint. The matter was then submitted to our board of review, the members of which unanimously recommended the issuance of a complaint under Sec. 7 of the Clayton Act.

"Since, in my opinion, the enforcement of Sec. 7 of the Clayton Act is one of the most, if not the most, important duty laid upon the commission, and since there can be no question in view of their producing capacity, and the sale by the two companies of 20 per cent of the copper used in the United States, that public interest is involved, I am constrained to dissent from the action of the majority in refusing to issue a complaint and try this case."

Thompson Opposes New Ruling

In connection with the new ruling that no statement regarding the application for a complaint shall be made unless the commission decides to issue the complaint, Commissioner Thompson says:

"I vote 'no,' and I wish the record to show that I protest against the enactment of this rule.

"The statute—The Federal Trade Commission Act—in its first paragraph, clearly authorizes the right of a minority to be heard and to have representation.

"I am against this rule because it is contrary to the letter and spirit of the Federal Trade Commission Act and the constitution of the United States; because it will permit of star chamber proceedings to be carried on and the applicant not informed as to what is taking place; and because it will deprive a minority of the right to express its views publicly, and hence is wholly dangerous and perverse of the public welfare.

"I request that this statement shall be attached to and given out with any publicity in regard to this proposed rule."

London Letter

By W. A. Doman
Special Correspondent

Indian Manganese Mining Company Prospers Remarkably New Machinery and Standard-gage Railroad Planned—Pays 25 per Cent Dividends and Bonuses

London, April 21—One of the most prosperous of manganese-mining companies is the Central Provinces Manganese Ore Co., Ltd. (India). It was formed as the Central Provinces Prospecting Syndicate in 1908, and it has made remarkable progress. The demand for ore has been greater than the company's existing equipment could cope with, and modern machinery has had to be installed. There is on the property a very large supply of high-class manganese ore, and as the result of a visit of two of the directors to the United States, the company has made some good business contracts. The Railway Department in India, recognizing the importance of the company's manganese deposits, has made provision in its railway budget for a broad-gage line to take the place of a 2-ft. gage steam tramway between the Bengal-Nagpur railway and some of the company's mines. The financing of the Central Provinces Manganese Ore Co. has been conducted on somewhat remarkable lines, for in 1908 the vendors valued their assets at £300,000 only, and accepted shares, no shares being offered to the public. In 1923 150,000 bonus shares were issued, and now a further 300,000 shares are to be issued as bonus, to bring the issued capital and the value of the assets more into consonance. As the company has been paying dividends of about 25 per cent as well as bonuses, it is not surprising that the £1 shares have risen to over £9.

Lena Goldfields, a company operating in Siberia, but whose work has been stopped in consequence of conditions in Russia, is increasing its capital to £2,905,000 by the creation of 1,500,000 shares of £1 each. This would seem to indicate that the Soviet policy may turn in favor of the company, and permit it to resume its working of the Altai and Lenskoie mines.

Hopes are entertained that the position at the Burma Corporation mine will soon be recognizable. As pointed out previously, certain engineers were of opinion that the character of the ore might be changed by the fire, though possibly not to any serious extent. It is not at all improbable, however, that in consequence of the restriction of operations to a relatively small number of stopes, thus preventing the treatment of run-of-mine ore, the flow sheet may have been upset. It is possible, too, that the outbreak may prove a blessing in disguise, for owing to the demand that is expected for lead, and to the fact that the zinc smelters did not pay for the full lead and silver contents of the zinc concentrates, efforts will certainly be made to extract another ounce of silver and another unit of lead.

From time to time statements have been made that the old lead mines in Derbyshire were to be reopened, and I have on one or two occasions mentioned some of these properties. Evidently the price of lead, due to scarcity, is bringing matters to a head, for a syndicate formed in London is now prospecting the Matlock Valley, in Derbyshire, where some scores of old lead mines are derelict. About sixty of these mines, it is said, are to be unwatered and a company with a capital of £100,000 is being formed.

The Roskear shaft of the Dolcoath mine, Cornwall, has reached a depth of 1,000 ft. from the surface, and has been lined with brickwork; part of the permanent pumping plant will be installed at this depth. The shaft is to be sunk to at least 1,860 ft., for which ample funds are available, the government having granted a loan of £65,000 for the purpose, a year or so ago.

Launch Cornwall's First Tin Dredge at Goss Moors

The recent launching at Goss Moors, near Roche, Cornwall, of a 200-ton tin dredge marks a new departure in alluvial tin mining in Great Britain. The dredge cost approximately \$60,000, and, although a familiar feature of operations in the Malay Straits, has not been used in Cornwall until now.

The dredge has been constructed to the order of British Alluvial Tin Syndicates, Ltd., which has leased over 1,000 acres of alluvial tin deposits from Viscount Falmouth. The dredging and concentrating machinery on the ship is worked by three 80-hp. engines. It has forty buckets, which are capable of mining three tons of alluvials per minute, and has on board 16,000 sq. ft. of dressing tables.

The area to be worked is estimated to yield 7,000 tons of tin concentrates. The prospects of a long period of work for a considerable number of men is a source of great satisfaction.

High Freight Rates on Gilsonite Held Justified

Rates being charged on gilsonite by the United Railway Co. in Uintah County, Utah, have been found to be reasonable by the Interstate Commerce Commission. It had been contended that the Barber Asphalt Co., which owns a narrow-gage as an adjunct to its mining operations, was securing an unfair trade advantage through the maintenance of high freight rates. By securing excessive profits from transportation activities, the Barber company was able to recoup losses resulting from sales, it was alleged.

The commission's analysis of operating costs on the Uintah line sets out in striking way the difficulties which had to be overcome to provide an outlet for Utah's gilsonite mines. Two Shay engines are required to take a 160-ton train over the 5 per cent grade and uncompensated curves over Book Cliffs. On the descent, the uniform grade is 7.5 per cent, with uncompensated curves of a maximum of 82 deg. and with practically no tangents.

Men You Should Know About

H. H. Knox is back in London after a winter spent in Burma.

Hally B. Bulmer, mining engineer of Virginia City, Nev., was recently married.

George H. Garrey, who was in New York last week, has returned to his Philadelphia office.

Morton Webber, mining engineer, of New York, was recently in San Francisco on professional business.

John G. Kirchen, general manager of the Tonopah Extension Mining Co., has returned to Tonopah from San Francisco.

Morris A. Newman, mining engineer of San Francisco, has just returned from a professional trip to Zacatecas, Mexico.

Jefferson Middleton, of the U. S. Geological Survey, is doing field work in New Jersey in connection with Mineral Resources work.

Senator Key Pittman has returned to Nevada, and will spend the greater part of the spring and summer in various parts of the state.

R. E. Allen, of Los Angeles, Calif., is now in charge of oil-boring operations for the Lander company at Orallo, Queensland, Australia.

Wilbur H. Grant, mining engineer and geologist, has returned from Mexico, where he has been on professional business, to San Francisco.

J. G. Farquhar, treasurer of the Big Lake Oil Co. of Pittsburgh, Pa., recently visited the company's producing properties in Regan County, Tex.

Charles A. Chase, mining engineer, who has been in Mexico on professional investigations for three months, will return to Denver sometime in May.

William Fagergren, metallurgist, of Salt Lake City, has gone to Winthrop, Calif., to supervise the erection of a flotation plant for the California Zinc Co.

Harry Donaldson, former manager of the Beaver mine of Cobalt, Ont., has been engaged as superintendent of the Kirk Gold mine, in the Kirkland Lake area.

C. E. Hart, general manager of the Louis d'Or Mining Co., at Miami Ariz., has been making an examination of some reported tin deposits near Hot Springs, N. M.

Pomeroy C. Merrill, mining engineer, has accepted a position as engineer with the Calcito Quarry Co., at Myerstown, Pa. Mr. Merrill was formerly with the Mond Nickel Co.

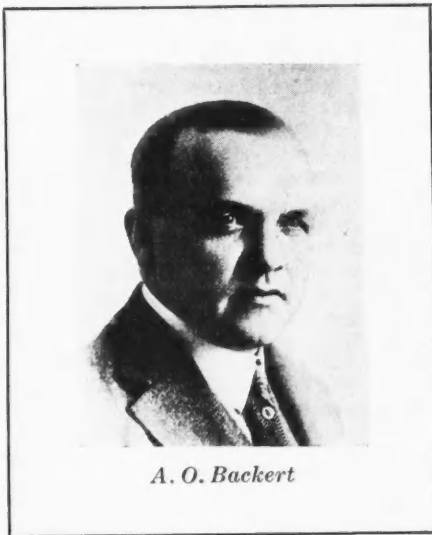
Edward Thornton, of the Southwestern Engineering Corporation, Los Angeles, is in Mexico on a visit of inspection of the property of the Southwestern Exploration Co.

J. A. Veatch, hydraulic mining engineer, has returned from Panama, to the Royal Drift mine, of which he is manager. The Royal Drift is on Butte Creek near Chico, Calif.

Nelson Dickerman returned to New York from Chile the last of April and will be at his New York office, at 512 Fifth Ave., for several weeks before proceeding to San Francisco.

Roger R. Brunshwig, of Amsterdam, who is a director of the N. V. Erts Mineral Co., is in British Columbia, seeking zinc, lead, and copper ores and concentrates for the company's plant in Holland.

A. W. Stickney, mining geologist, has completed a geological examination of the Benguet property, in the Philippine Islands, and was recently in San Francisco en route to his home at Galesburg, Ill.



A. O. Backert

F. J. Katz is visiting the branch offices of the U. S. Geological Survey and will do other work in connection with mineral resources. During his absence **J. P. Dunlop** will be in charge of the Minerals Resources Division in Washington.

George L. McCann, recently associated with Sam Houghton in the development of the Graphic mine, at Cook's Peak, and formerly with the Chino, at Santa Rita, and the Hanover-Bessemer company, at Fierro, has given up mining for the present and is in El Paso as district sales manager for a New York concern.

C. E. Wethered, of Wallace, Idaho, mining engineer, for many years connected with the Federal Mining & Smelting Co., is now superintendent of the Morning mine. **J. E. Berg**, also a mining engineer in the service of the Federal, is assistant superintendent. They succeed respectively **Michael Murray** and **C. A. Fay**.

H. C. Richards, professor of geology in the University of Queensland, Australia, returned to Brisbane at the end of February from a visit to California. In a press interview he made special reference to the Californian oil fields, and mentioned the one at Signal Hill, near Los Angeles, as illustrative of the value of geological investigation before boring.

Paul M. Tyler, who resigned as chief of the Metals Division of the U. S. Tariff Commission a year ago to engage in private business, has been re-employed by the commission as an expert in the same division. **F. M. Leonard** remains acting chief of the division. Mr. Tyler will assist in the investigation into costs of production of magnesite which has been reopened by the commission, and in other work of the Metals Division.

The Ontario Department of Mines has made arrangements for field work during the season as follows: **E. W. Todd** will make an examination of the Anima Nipissing area west of Gillies Limit and east of Evelyn Lake. **J. E. Hawley** will examine three townships lying southwest of Timmins. **Dr. E. S. Bruce** will explore the area south of Porcupine, including the unmapped townships of Douglas and Fallon and parts of Geikie and Cleaver townships. **T. L. Gledhill** will examine mine townships to the south of that area. **F. L. Finley** will make an examination of six townships lying further south of the same area, including the northern parts of Connaugh and McMurchy townships. **Dr. E. S. Bruce** will continue his examination of the iron ranges between Batachewana station on the Algoma Central Ry. and Pancake Bay and Copper Point, on Lake Superior. **G. Vibert Douglas** will be attached to the Traverse party of **J. W. Pierce**, who will follow up a photographic survey from Red Lake to Island Lake at a distance approximately 50 miles east of the Ontario-Manitoba boundary.

Obituary

A. O. Backert, president of the Penton Publishing Company and for a number of years on the editorial staff and finally editor of the *Iron Trade Review*, died at his home in Cleveland Friday, April 24. He was very prominent in technical publishing circles as well as in the iron and steel business. His career was testimony of the opportunity for service open to the technical journalist. Never a producer or merchant of iron and steel products, he so saturated himself with the atmosphere of the business that for years he had been admitted to its inner circles as a valued advisor. He was not technically educated, but he learned early in his editorial life the value of study of his specialty, and he long ago became known as an expert, not only in the business of iron and steel but also in its technology. In foundry practice especially he had for years been one of the leaders. In his later life, when his administrative duties as head of a large publishing company made it impossible for him to continue close editorial contact with his field, he still retained the confidence of the industry and improved every occasion to capitalize that confidence in advice and suggestion to his editorial associates.

Edward Carrington Miles, eighty-three, a retired mining engineer, died on April 25 in his home, No. 124 East 40th St., New York City.

Societies, Addresses, and Reports

Zinc Institute Elects Cobb President

Interests of Miner and Smelter Discussed by E. H. Wolff and
L. E. Wemple at St. Louis Meeting—May Go to
Hot Springs Next Year

By Philip Coldren



Photo by Aimé Dupont, New York.

A. Polhemus Cobb

A. P. COBB, vice-president of the New Jersey Zinc Co., was elected president of the American Zinc Institute for the ensuing year, at the annual meeting of the organization held at the Statler Hotel, in St. Louis, Mo., on April 27 and 28. He succeeds A. E. Bendelari, of Chicago, vice-president of the Eagle-Picher Lead Co., who had held the office one year and declined a renomination. Howard I. Young, of Mascot, Tenn., was re-elected treasurer, and Stephen S. Tuthill, of New York, secretary.

Mr. Bendelari, Jesse G. Starr, of Joplin, and John A. McCarthy, of New York, were elected vice-presidents. Messrs. Cobb, Bendelari, A. M. Gaines, Charles T. Orr, and E. H. Wolff, of Joplin; J. F. Robinson, of Miami, Okla.; and William Rossman, of St. Louis, were elected as directors for a three-year term, and L. E. Wemple, of Peru, Ill., Charles A. H. de Saulles, of New York, and John W. Newton, of Miami, were added to the directorate.

Attendance was good at the meeting, which was marked by the frankest discussion of the divergent but common interests of the mine operator and smelter man that has taken place at any of the yearly sessions. This discussion was precipitated on the first day of the meeting by papers read by E. H. Wolff, of Joplin, on "The Miner's Viewpoint," and by Leland E. Wemple, of Peru, on "The Smelter's Viewpoint."

Mr. Wolff, who formerly was vice-president and manager of the Illinois Zinc Co., expressed his belief that the day is past when the miner will exhaust his mineral deposits and sell them at a price less than the cost of production. He said the miner of today is a wiser man, a larger producer, and with a broader vision.

"Before the war," said Mr. Wolff, "very little slab zinc was sent out of the country, and the smelting business was probably more profitable than it has been over the last year or two, during which time there has been more slab zinc exported than ever before. Out of your monthly production you have been exporting 10 to 15 per cent, and the sale of this small part of the entire production has set the price for all of it. I believe the entire industry would be better off if we were back to the basis of no exports, but, failing that, why compete for the opportunity to export at a less than cost price if it brings a loss? One smelting company could easily satisfy all export demand for slab zinc, and if that company refused to sell, except at a fair price on this side, we would soon be free from the dominance of the European market. Looking upon the situation as a miner, you smelting people can put your own house in order without help from us, but if you want our co-operation, I feel sure the doors are open.

"I still believe contracts in the ore field would solve our most difficult problem, but if the smelter side of the industry is satisfied to let things drift along without profit to themselves and make no effort to bring about better conditions, why should the miner worry except to get a fair price for his ore, and prevent loss to himself?

"The miners to some extent believe the slab zinc market is manipulated for the benefit of the manufacturers, and no one would consent to sell his ore on a contract based on the metal market. They are not in touch with the metal markets, nor do they understand how the markets are made. Why not try to explain your marketing problems to these men?

"Some of the smelter men believe the miner is always on top of the ore market, and after a profit regardless of price. This misapprehension comes from lack of information. How many smelter owners, or men in charge of operations, have ever been over the mining field, or underground, or made the acquaintance of the miners to whom they are beholden for their business existence? A prominent zinc man told me a few years ago that his company had an agent at Joplin who had been buying ore for his company for twenty years, and he had never seen him. You must cease being indifferent to changing conditions, take an interest in the miner and his problems, and he will become interested in yours. Co-operate to some definite end for the good of the industry—and do it yourselves instead of through agents."

THE SMELTER'S VIEWPOINT

In discussing the smelter man's viewpoint, Mr. Wemple pointed out that conditions are changing and that the old custom of classifying the zinc industry into two groups is scarcely correct any more. He said:

"Just who are the zinc smelters today? Three of those commonly looked upon as large producers of spelter are now in reality pigment manufacturers. Two are the subsidiaries of galvanized iron manufacturers. Two now operating retort furnaces are essentially rollers of zinc metal, a distinct fabricating business. One is a large mixed acid and chemical manufacturer. Three others are general smelters and brokers of lead and copper as well as zinc.

"It is clearly evident that the slab zinc production *per se* is essentially a byproduct commodity. Statistics show that 41 per cent of the total retorts in the country have been idle for the past three years—more evidence that the production of spelter has passed from a primary industry to a secondary industry.

"The 530,000 tons of annual production during the last two years has come from operation of smelters that are trying to hold on to their smelting organizations in the hope of making profits in the future, or from ore producers owning smelters, or from acid makers who produced spelter as a byproduct, or from rolling mills whose demand for rolled metal did not equal their spelter production, or from galvanizers whose production was used by themselves or others. It did not come from directly profitable zinc smelting plants."

He further called attention to the entrance of several smelting companies into zinc-ore mining, and predicted an increase in such operations. Incidentally, he suggested that the time is ripe for the ore producers to dip into the smelting business.

"The ore producer does not differ from the producer of any other commodity in that his product is valueless until it finds a market, and he cannot promote conditions which destroy that market without in turn hurting his own interests. As outlined before, the ore producer's market has been already curtailed, and he cannot expect the smelters to do other than adapt their smelting plants to produce commodities in which there exists more profit than smelting ore for the slab-zinc market."

COMMITTEE HOPES TO IRON OUT DIFFERENCES

As a result of the poignant discussion that followed these two papers, a special committee was appointed to iron out, if possible, the differences that exist between the smelting and mining factions of the industry. This committee, which consists of Julius Hegeler, William A. Ogg, and E. W. Furst, for the smelters, and F. C. Wallower, P. B. Butler, and John W. Newton, for the miners, reported the second day of the convention that though they had no definite accomplishment to report at the time, they are hopeful that something can be done along the line suggested.

It is understood two propositions are receiving consideration at the hands of this committee. One is the matter of ore purchasing on contract. The other, the possibility of turning over the export slab-zinc market to one smelting concern exclusively, as indirectly suggested by Mr. Wolff.

A year ago the Institute members voted to raise a fund of \$100,000 for advertising zinc, half of it to be raised by the mining and half by the smelting interests. The mining contingent finished the raising of its share of this fund early last summer; but the smelting portion has never been completed. The matter was brought up at this year's meeting, and it appears doubtful whether the fund will ever be completed. Men who had contributed to the mining men of the industry fund demanded a show-down, stating they wanted to know whether they were to get their money back or not. After some discussion, the new president, Mr. Cobb, promised to get in touch with the smelting concerns and make a final report by July 1.

Reasons for the failure of the smelting interests to make their contribution to the fund were reported as threefold: First, a year without profits. Second, inadequate ore supplies. Third, because the expenses of the Institute have been largely met by the smelting interests in the past and they do not feel a fifty-fifty division in raising this fund is fair.

F. C. Wallower, of Joplin, declared the smelters might have made some profits had the advertising campaign been started, that there is no shortage of ore supplies, and that if the ore-producing department of the industry has, in the past, failed to carry its end of the load, such a condition will be remedied in future.

The delegates were welcomed at the opening session by Victor J. Miller, newly elected mayor of St. Louis, a former Joplin man. Response was made by P. B. Butler, of Joplin. Informal remarks by President Bendelari and the reading of a letter from A. J. M. Sharpe concerning world conditions as to zinc made up the opening session.

In the afternoon session on Monday, in addition to the presentation of the Wolff and Wemple papers, there was a paper on "The Zinc Business," by Stewart A. Trench, and a discussion by Adolph Boldt, of the Chamber of Commerce of the United States.

On Tuesday, Robert Lepsoe's paper on electrothermic zinc smelting was read; C. S. Trewin, of the New Jersey Zinc Co., discussed zinc coating; and L. M. Richards talked on "The Story of Fire Clay Refractories." In the afternoon, C. O. Anderson, of the U. S. Bureau of Mines, presented a paper by Frank E. Weeks, of the Velie Mines Co., on milling practices in the Joplin-Miami district, which was followed by round-table discussion, in charge of Dr. Dorsey A. Lyon, of the U. S. Bureau of Mines.

Next year's meeting may be held at Hot Springs, Ark., a postal ballot being ordered to decide between it and St. Louis.

A vote of thanks was tendered Ralph M. Roosevelt, chairman of the committee on arrangements.

J. M. Hill Discusses California's Waning Gold Output

Says Better Methods and Lower Costs Are Necessary Before It Can Be Increased

At the meeting of the San Francisco Section of the American Institute of Mining and Metallurgical Engineers, on April 14, J. M. Hill, of the U. S. Geological Survey, informally discussed the waning production of gold in California. He presented a graphic chart, similar to the accompanying figure, which showed fluctuation in the annual gold production of the state from 1848 to 1923. He called attention to the fact that the rise of gold production in California before the war period was due largely to the production of the gold dredges. Adverse decisions, notably the Sawyer decision, had diminished gold production sharply in the 80's. The Caminetti Act had helped to restore some of this production, but hydraulic and placer mining, with the exception of gold dredging, now produce only a small annual return. Gold dredging will be a thing of the past in approximately ten years, and the adverse economic conditions are diminishing the production of lode gold.

Mr. Hill pointed out that much better mining, better metallurgy, and lower costs are necessary if gold production is to be increased. Hydraulic and drift mining offer possibilities of considerable expansion. Operating costs in the mining industries are now at a high point and must be reduced. Mr. Hill suggested that, if taxes in the mining industry are out of line with those in other industries, a proper showing of the facts should result in getting them reduced. He advocated a central buying organization for purchasing mine supplies as promising additional economy. He also favored a getting together of all of the metal and non-metallic mining interests in the state. The reorganization of the State Mining Bureau should be helpful in furthering mining interests in the state, he believes. The high-grading law recently enacted will be also generally helpful.

Iron and Steel Institute Will Meet May 22

The twenty-seventh general meeting of the American Iron and Steel Institute will be held at the Hotel Commodore, New York City, on Friday, May 22. There will be the usual sessions, morning and afternoon, at which Judge Gary will give his address and technical papers will be read. This will be followed by a banquet in the evening.

U. S. Chamber of Commerce to Meet at Washington May 20-22

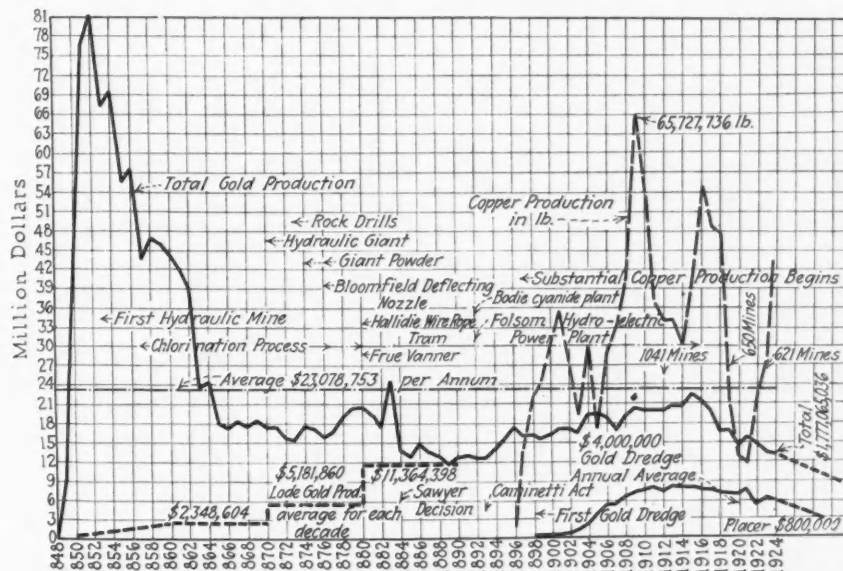
Some of the economic problems which are calling for attention on the part of both government and business will come before the thirteenth annual meeting of the Chamber of Commerce of the United States at Washington on May 20 to 22. Their discussion will be undertaken by representatives of the Administration and by leading business men.

The main subjects selected for the general sessions of the meeting are as follows: "The European Situation," "American Business Conditions," "Commercial Treaty Policy," "The Merchant Marine," "The Federal Trade Commission," "Congress and the American Public" and "Agriculture."

Registration clerks will be located at the headquarters, the Washington Auditorium, the Willard Hotel, the Washington Hotel and the Mayflower Hotel.

Mining Convention at Cranbrook on May 19

The annual mining convention organized by the Associated Boards of Trade for Eastern British Columbia will be held at Cranbrook on May 19 and three following days. Arrangements have been made for visits to the East Kootenay Power Co.'s new hydroelectric installation, at Elko, and to the Sullivan mine and mill, where the delegates will be the guests of the Consolidated Mining & Smelting Co. of Canada. Special excursions are being arranged for ladies.

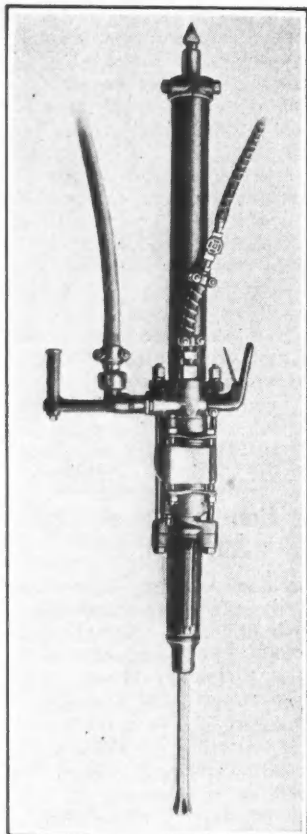


Statistics showing California's gold production since 1848—U. S. Geological Survey

New Machinery and Inventions

A New Rotating Water Stoper

In the new "DU-48" rotating water stoper now being built in commercial quantities, the designers of the Sullivan Machinery Co. feel that they have concluded the pioneering stages in water stoppers and are able to present a finished and standardized product to the mining industry. Principles and details, which gave success in the company's rotators and mounted water hammer drills for sinking, drifting, and like operations, have been adapted with



This new rotating water stoper weighs 102 lb., uses 1-in. hollow quarter-octagon steel, and will drill 2-in. holes to a depth of 10 ft.

suitable modifications into the design of the new stoper.

The "DU-48" is a valve drill. The valve and piston motion follows the design of the DW-64 drifter, the valve being of the spool type. This valve motion gives a powerful piston blow, with sharp recover, while end cushions in the cylinder provide the needed element of smoothness and balance in operation.

Only sufficient water is admitted through a needle valve in the water hose line to provide a thin paste of mud, in combination with the cuttings, which will run readily from the drill hole, but does not result in unnecessary flooding. Air from the main line combines with the water to force the latter through the tube and into the rear of the hollow drill steel. There is no leakage at the front end of the drill, and the only water noticeable in connection

with the operation is that which falls from the drill hole itself.

The rotation of the drill steel also follows that of the drifting drill. It consists of a rifle bar and ratchet collar, located in the rear end of the drill cylinders, the rotation being carried forward through the piston to the rotating chuck at the front end. The chuck is dust-tight and water-tight, and is lubricated automatically from a front-end storage chamber by the pulsation method. It is still necessary for the miner to put additional lubricant in the chambers provided, but if he does this no further attention on his part is needed. It may be noted that the steady handle, by which the operator controls the machine and holds it in line, is hollow, and furnishes one of the storage chambers for oil.

The control of the feed is also almost automatic. A small lever at the base of the regular throttle handle is placed so that it may be grasped by the fingers of the same hand when operating the throttle. To stop or retard the advance of the machine on the feed piston, the operator merely squeezes this lever in toward the throttle handle, thus cutting off the supply of air to the feed cylinders. By this method, also, the runner can control the withdrawal of the stoper from the hole when the steel has been run down. He can drop the machine on the feed piston almost instantly, or by degrees, as desired, in withdrawing the steel.

The new stoper weighs 102 lb., has a cylinder diameter of 2 $\frac{1}{4}$ in., is 54 $\frac{1}{2}$ in. long with the feed piston in, and has a feed of 18 in. It uses 1-in. hollow quarter-octagon steel, and will drill 2-in. holes to a depth of 10 ft. It is described in Bulletin 81-G.

Improved Disconnecting Switch

In a new line of disconnecting switches now being marketed by the General Electric Co., and known as Type LG-17, the cantilever strength of the insulator unit has been greatly increased by a double-crimped cap and the addition of a pin cast integral with the lower fitting. The new type also possesses a number of other desirable features. Both hinge and contact clips are cast integral with their blocks; the blade of the switch, being in two sections, possesses much more lateral rigidity than if the blade were of a single piece, and the use of bolts through the two sections of the blade, above and below the clip, provides a convenient means of adjustment or readjustment of contact pressure.

All forms of the switch are furnished with a new type of latch or safety catch. On double-throw switches there is a latch at each end. The action of the latch is positive and combines both latching and opening features.

A new switch hook is also included in the development, incorporating both a special "V" hook for the LG-17 and a standard hook for operating other forms of disconnecting switches and latches.

Carels to Handle New Line

The Traylor Engineering & Manufacturing Co., of Allentown, Pa., manufacturers of mining, crushing, and cement machinery, has made arrangements to have its products for Europe, and the Far East manufactured by the Usines Carels Freres, Société d'Electricité & de Mécanique, at Ghent, Belgium. This plant is the European connection of the International General Electric Co.

Trade Catalogs

Rock Dusting—Bulletin No. 21, entitled "Rock Dusting of Coal Mines," issued by the Hardinge Company, York, Pa., describes the Hardinge stationary pulverizing plant and the Hardinge portable pulverizer and duster.

D. C. Generators—Engberg direct-current generating sets for dredge, steam shovel and magnet crane service, and for marine and other use, are described in Catalog No. 105, issued by Engberg's Electric & Mechanical Works, St. Joseph, Mich.

Hoists—Roeper electric Type R hoists, capacities 500 to 4,000 lb. inclusive, are covered in a four-page descriptive folder issued by Roeper (formerly Reading) Crane & Hoist Works, Inc., 1720 North 10th St., Reading, Pa.

Screws, Nuts, etc.—The Pheoll Manufacturing Co., Chicago, Ill., has issued a 97-page indexed catalog of screws, bolts, rivets and nuts.

Mine, Mill, Smelter Equipment—Catalog No. 25, 80 pages, illustrated, issued by Cœur d'Alene Hardware & Foundry Co., Wallace, Idaho, describes its varied line of machinery for mines, mills and smelters.

Rubber Goods—The Goodyear Tire & Rubber Co., of Akron, Ohio, has issued a 164-page handbook covering its line of mechanical rubber goods. In it 56 pages are devoted to belting and 60 pages to hose.

Loading Machines—Bulletin No. 12 of the Conveying Weigher Co., 90 West St., New York, has 8 pages of matter describing the Conweigh digger belt loader.

Flotation Machine—Simpson Engineering Co., Box 398, Long Beach, Calif., has issued Bulletin D, 8 pages, illustrated, describing the new Simpson pneumatic flotation cell.

Lubrication—Bulletin No. 112 of the Hill Clutch Machine & Foundry Co., Cleveland, Ohio, calls attention to the patented Cleveland type collar-oiling bearing.

Shoveling Machine—Myers-Whaley Co., Knoxville, Tenn., are distributing a paper entitled "Design, Manufacture, and Use of the Myers-Whaley Underground Shoveling Machine," which was presented by William Whaley at the Feb. 2 meeting of the Knoxville Section of the A.S.M.E.

Dump Cars—Lorries, dump cars, and locomotives are covered in Bulletin 139, 4 pages, issued by the Bloomsburg Locomotive Works, Bloomsburg, Pa.

The Market Report

Daily Prices of Metals

Apr. May	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
30	13.35	53.875	54.875	7.75	7.50	6.875
1	13.25@13.30	52.75	53.50	7.75@7.80	7.375@7.40	6.80
2	13.25	53.00	53.75	7.75	7.40	6.75@6.85
4	13.25	53.25	54.00	7.75	7.45	6.875@6.90
5	13.275	54.00	54.75	7.75	7.50	6.90@6.95
6	13.35	53.25	54.00	7.75@7.80	7.50	6.90@6.95
Av.	13.292	53.354	54.146	7.75 ⁸	7.456	6.869

*The prices correspond to the following quotations for copper delivered: April 30th, 13.60c.; May 1st, 13.50@13.55c.; 2nd and 4th, 13.50c.; 5th, 13.525c.; 6th, 13.60c.

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.

Average Metal Prices for April, 1925

Copper:	
New York Electrolytic.....	13.252
London Standard.....	60.575
London Electrolytic.....	64.194
Lead:	
New York.....	8.005
St. Louis.....	7.662
London.....	32.791
Silver:	
New York.....	66.899
London.....	31.372
Sterling Exchange.....	479.034
Zinc:	
St. Louis.....	6.985
London.....	34.644
Tin:	
99 per cent.....	51.380
Straits.....	52.135
London.....	237.006
Quicksilver	82.327
Antimony	12.553
Platinum:	
Refined.....	118.269
Crude.....	114.769

London

Apr. May	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
30	60 ³ / ₄	61 ¹ / ₂	64 ¹ / ₂	245	247 ¹ / ₂	32 ¹ / ₈	31 ¹ / ₁₆	34 ¹ / ₂	33 ¹ / ₂
1	59 ¹ / ₂	60 ¹ / ₂	63 ¹ / ₂	236 ¹ / ₂	239 ¹ / ₂	31 ³ / ₈	31 ¹ / ₈	33 ¹ / ₂	32 ³ / ₈
4	59 ¹ / ₂	60 ¹ / ₂	63 ¹ / ₂	238 ¹ / ₄	241 ¹ / ₄	31 ¹ / ₂	31 ³ / ₈	34	32 ⁷ / ₈
5	60 ¹ / ₄	61 ¹ / ₄	63 ¹ / ₂	241 ¹ / ₄	244	32 ¹ / ₂	32	34 ³ / ₁₆	33 ¹ / ₈
6	60	61	63 ¹ / ₂	242 ³ / ₄	244 ³ / ₄	32 ¹ / ₈	31 ¹ / ₂	34 ⁵ / ₁₆	33 ³ / ₈

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

Silver, Gold, and Sterling Exchange

Apr. May	Sterling Exchange "Checks"	Silver		Gold London	May	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
30	4.84	67 ¹ / ₈	31 ¹ / ₈	84s 11 ¹ / ₂ d	4	4.84	67 ¹ / ₂	31 ⁵ / ₁₆	84s 11 ¹ / ₂ d
1	4.84	67 ¹ / ₂	31 ¹ / ₁₆	84s 11 ¹ / ₂ d	5	4.85	67 ³ / ₈	31 ¹ / ₂	84s 11 ¹ / ₂ d
2	4.84	67 ¹ / ₈	31 ¹ / ₁₆	6	4.84 ³ / ₄	67 ³ / ₈	31 ³ / ₈	84s 11 ¹ / ₄ d

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

An Inactive Week in the Metal Market

New York, May 6, 1925—The week ending today has been an inactive one for metal sellers, only a moderate business being done in lead and copper and even less than that in zinc and tin. Prices of most of the metals have shown slight tendencies to advance in the last two or three days, however, owing to better cables from London. Domestic consumers continue to buy only for current requirements.

Export Market Supports Copper

The volume of sales reported by copper sellers this week was much less than last. Most of the business was

done at 13¹/₂c. delivered, Valley, the serious break in the London price last Friday being responsible for the decline to that level. Brass manufacturers bought moderately on Friday, Saturday, and Monday, but yesterday and today have refused to follow the market upward. Sellers have revised their quotations to 13³/₄c., with hardly an exception, but in one or two directions small concessions have been made on a few hundred tons, and only a very small amount has brought the full 13³/₄c. price in the East. Several buyers would be willing to pay 13¹/₂c. today, but with the export demand fairly good at 13.75@13.80c., c.i.f., producers are not inclined to book

domestic business at that level. Brass makers report a good total volume of business, but in smaller individual lots than usual and for earlier delivery. Every one is apparently playing safe.

Lead Slightly Stronger

The contract price of the American Smelting & Refining Co. continues at 7.75c. per lb., New York. Sales of lead have been moderate in both the New York and St. Louis markets. In New York a little lead was sold for 7.80c., but by far the greatest tonnage was sold for 7.75c. The price in St. Louis has gradually moved upward to 7.50c., with a heavy sale made on May 1 at 7.375c. Producers are in comfortable position, and still have May lead available. The market has been governed more by the fluctuations in London than usual. Consumption of lead during March and April was lower than for the two previous months, but there are signs that demand is waking up.

Zinc in Meager Demand

Zinc business has been in rather small volume this last week, especially for Prime Western grade, galvanizers having bought only a few hundred tons. Brass Special has been in only fair demand, as has high-grade, the last-named continuing to be sold at 8¹/₂@8³/₄c. delivered. Some zinc has been sold for export, the slight continual advances in the London price since Friday being encouraging, and the sole reason for the corresponding advance in the domestic market. Today bids of 6.90c. were made, most sellers asking 6.95c. for all deliveries. The slight boom in London seems to be confined to the Metal Exchange. Prime Western in New York continues at the freight differential of 35c. per 100 lb. above the St. Louis market.

Tin Makes Further Advances

Prices of tin have been governed almost wholly by the activities of London dealers. Tin-plate manufacturers have not participated extensively in the domestic market. Spot Straits is at a premium over future shipment.

Silver Advances

The silver market has advanced slightly in both London and New York, owing to improvements in China exchanges and continued shipments to the Continent from both New York and Mexico. India at current rates is not a keen buyer.

Mexican Dollars—April 30th, 51½c.; May 1st, 2d, and 4th, 52c.; 5th, 52½c.; 6th, 52c.

Foreign Exchanges Improve

Most foreign exchanges improved slightly. Closing cable quotations on Tuesday, May 5, were: francs, 5.245c.; lire, 4.1075c.; and marks 23.81c. Canadian dollars, 3/32 per cent premium.

Lead Ore Steady—Zinc Blende Lower, with Few Sales

Joplin, Mo., May 2, 1925

Zinc Blende	Per Ton
High	\$53.20
Premium, basis 60 per cent zinc	\$51.00@51.50
Prime Western, 60 per cent zinc	\$47.00@47.50
Fines and slimes, 60 per cent zinc	\$46.00@43.50
Average settling price, all.	\$48.91
Lead Ore	
High	\$105.70
Basis 80 per cent lead	\$90.00
Average settling price, all.	\$96.05

Shipments for the week: Blende, 15,593; lead, 1,938 tons. Value, all ores the week, \$953,860.

Buyers and sellers opposed each other throughout the day over a basis price for ore. Prices as quoted above ruled until 5 o'clock this afternoon, with no break reported in the general market tone.

Twenty-five mills continue with night-shift operations, but enough mills are down for repairs to strongly influence the output, estimated as reduced between three and four thousand tons below maximum production, which is around 17,000 tons per week. This week's output, it is claimed by sellers, was less than 14,000 tons. Shipments this year have averaged 15,531 tons per week.

Platteville, Wis., May 2, 1925

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	\$50.00
Lead Ore	
Lead, basis 80 per cent lead	\$93.50

Shipments for the week: Blende, 1,088 tons; lead, none. Shipments for the year: Blende, 12,837; lead, 707 tons. Shipments for the week to separating plants, 1,688 tons blende.

Steel Consumption Heavy

Pittsburgh, Pa., May 5, 1925

The volume of steel buying is practically unchanged. Freight-car business is almost exhausted, but more is expected.

Steel prices have shown no strengthening at any point. First-quarter earnings of steel companies were fair, but, being made on an exceptionally heavy tonnage, indicate that profits per ton ought to be larger in several lines to make even a moderate showing.

Steel consumption is running heavy in all quarters. Only in oil-well drilling is there distinctly less activity than could reasonably have been expected at the beginning of the year.

Pig Iron.—There is practically no buying. Furnaces are piling iron, and some will probably have to go out. Quotable prices are unchanged at \$21 for bessemer and \$20 for basic and foundry, but are largely nominal, not being tested.

Connellsville Coke. — Spot furnace, \$3@3.25; spot foundry, \$4@4.50.

Other Metals

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

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

Antimony—Per lb.: Chinese brands, nominal, 12@12.50c. Cookson's "C" grade, 15½c. Chinese needle, lump, nominal, 10c. Standard powdered needle, 200 mesh. 11½@13c.

White oxide, Chinese, 99 per cent Sb₂O₃, 16@16½c.

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

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

Cobalt—\$2.50@3 per lb. Discounts on contracts. Oxide, \$2.10@2.25. London, 10s. for metal; 8s. for black oxide.

Germanium Oxide—25 to 50 gm. lots, \$7.50 per gm.

Iridium—\$375@\$400 per oz. Nominal.

Lithium—95@96 per cent grade in 1 to 5 lb. lots, \$75 per lb.

Magnesium—Sticks, 1½ in., 99.9 per cent, 90c.@1 per lb. Prices quoted depend upon size of lot ordered. Larger lots at concessions and available for prompt shipment.

London quotes 4s. for 99 per cent ingots or sticks.

Molybdenum—99 per cent, \$25 per kg.

Monel Metal—32c. per lb.

Nickel—Ingot, 31c.; shot, 32c.; electrolytic, 38c. (99.75 per cent grade). London, £170@£175 per long ton.

Market fairly active. Export inquiries have been placed recently.

Osmiridium—Crude, \$58.50 per oz.

Osmium—\$100@\$104 per oz.

Palladium—\$79@\$83 per oz. Crude, \$60 per oz. London, £17½.

Platinum—Refined, April 30, May 1 and 2, \$118.50; 4, 5, and 6, \$120 per oz. Crude, \$115.

London, £24½ per oz. for refined.

Quicksilver — Per 75-lb. flask, \$81. San Francisco wires, \$81.65. Quiet. London £13½.

Radium—\$70 per mg. radium content.

Rhodium—\$85@\$90 per oz.

Ruthenium—\$40@\$45 per oz.

Price furnished by Foote Mineral Co., Philadelphia.

Selenium—Black powdered, amorphous, 99.5 per cent pure, \$2.20 per lb.

Tantalum—Metal sheets, \$275 per lb.

Tellurium—\$2 per lb.

Thallium Metal—Ingot, 99 per cent pure, \$5 per lb. in 25-lb. lots.

Tungsten Metal—Powder, 97 to 98 per cent, \$1 per lb. contained tungsten. More active interest in market. Prices have advanced.

Zirconium Metal—98 per cent grade, per lb., \$30.

Metallic Ores

Chrome Ore—Per ton, c.i.f. Atlantic ports:

Indian, \$20@\$22.50.

Rhodesian, \$22.

New Caledonian, \$24.

Market nominal.

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

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

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

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

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

Eastern ores, cents per unit delivered at furnaces:

Foundry and basic, 53 to 63 per cent, 8.75c.

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

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

Spanish, low phosphorus, 52@54 per cent, 8@9½c.

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

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

Manganese Ore—45c. per long ton unit, seaport exclusive of duty. Market nominal. Chemical grades¹, powdered, coarse or fine, 82@87 per cent MnO₂, Brazilian, and Cuban, \$70@\$80 per ton in carloads.

Molybdenum Ore—60@70c. per lb. of MoS₂ for 85 per cent MoS, concentrates. Nominal.

Tantalum Ore—Foreign, 30@50c. per lb. of Ta₂O₅ contained, c.i.f. New York, according to quality.

Tungsten Ore—Per unit, N. Y.:

High-grade wolframite, \$11.

High-grade scheelite, \$11.25.

Market firm. Chinese wolframite recently imported. Supplies scarce.

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

Non-Metallic Minerals

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

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

Asbestos:
Crude No. 1—\$375@\$450.

Crude No. 2—\$225@\$300.
 Spinning fibers—\$100@\$200.
 Magnesia and compressed sheet fibers—\$65@\$115.
 Shingle stock—\$50@\$70.
 Paper stock—\$35@\$40.
 Cement stock—\$15@\$25.
 Floats—\$9@\$12.
 Sand—\$6@\$8.

All per short ton, f.o.b. mine, Quebec, tax and bags included.
 No. 1 Rhodesian crude, \$280; No. 2, \$200@\$225 per short ton, c.i.f. New York.

Market much better. Consumers buying far ahead. Production has been curtailed. Demand seems to be increasing. Higher prices are anticipated if merger is accomplished, and condition of industry is expected to improve.

Barytes—f.o.b. Kings Creek, S. C.:
 Crude, \$7@\$8 per gross ton.
 Ground, off color, \$14 per ton.
 White, bleached, \$17 per ton.
Waterground, 300 mesh, bags included, \$22 per ton, Charlotte, N. C.
 Crude, \$8, f.o.b. Ga.
 Crude, \$8.50, f.o.b. Mo.
Water ground and floated, bleached, \$23@\$24, f.o.b. St. Louis.
 In Canada, 94@96 per cent BaSO₄, \$9 per net ton, f.o.b. mine.

Demand remains steady and will doubtless follow the varying production of the rubber industry. Producers predict a decline in production about June 1.

Bauxite—American, f.o.b. shipping point per gross ton:
 Crushed and dried, \$5.50@\$8.50.
 Pulverized and dried, \$14.
 Calcined, crushed, \$19@\$20.
 Foreign, per metric ton, c.i.f.:
 French red, 5 per cent SiO₂, \$5@\$7.
 Adriatic, low SiO₂, \$4@\$6.50.
Beryl—\$65@\$80 per ton, hand-sorted crystals, in ton lots f.o.b. Vermont. Nominal.

Borax—Granulated or powdered, in bags, 4½c. per lb., delivered. Crystals, 5c. Market normal.

Celestite—90 per cent SrSO₄, finely powdered, \$40 per ton in carload lots.
Chalk—F.o.b. New York, per lb.:
 English, extra light, 5c.
 Domestic, light, 4½@4¾c.
 Domestic, heavy, 3½@3¾c.
 In bulk, \$5@\$5.50 per ton.

China Clay (Kaolin)—F.o.b. Virginia mines, per short ton:
 Crude No. 1, \$7.
 Crude No. 2, \$5.50.
 Washed, \$8.
 Powdered, \$10@\$20.
 Powdered (Blue Ridge), \$10@\$14.
 Imported English, f.o.b. American ports:

Lump, \$12@\$20.
 Powdered, \$45@\$50.
 1A grades, domestic, \$16@\$18, f.o.b. mines. Market dull.

Corundum—South African, \$65 per ton, New York.

Diatomaceous Earth—Per short ton, f.o.b. plant, California:
 Kiln-fired brick, \$65
 Kiln-fired aggregate, ½ in., \$45.
 Insulating powder, \$30.
 Natural aggregate, ½ in., \$20.
 Air-floated powder, \$40.
 In New England, per ton:
 Pulverized, \$65.
 Air float, \$75.

Emery—Per lb., f.o.b. plant:
 Greek Naxos, 6½c.
 Turkish, 6½c.
 Khasia, 5½c.
 American, 3½c.
 Market reported good.
Feldspar—Per long ton, f.o.b. cars,
North Carolina:
 No. 1 pottery grade, \$5.75@\$6.50, depending upon quality.
 No. 2 pottery grade, \$4.50@\$5, depending upon quality.
 No. 1 soap grade, \$6.75@\$7.25.

In Connecticut, per net ton, f.o.b. mines:
 40 to 200 mesh, \$16@\$30.
 In New Hampshire, per net ton, f.o.b. mines:

No. 1, not over 10 per cent SiO₂, \$7.25.
 No. 2 pottery grade, \$7.
 Ground, \$17@\$20, f.o.b. mill.
 Market fair.

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

In Maine:
 No. 1, ground, \$19.

In Tennessee:
 Pottery grades, \$16@\$21, according to analysis and mesh.

Tile grades, \$14@\$16.
 Enameling grades, \$11@\$16.
 Crude, \$7 for ordinary grades. As high as \$7.25 offered for exceptional quality.

Market improving.
 In Virginia:
 No. 1 Porcelain, 140 mesh, \$23.
 Enamellers' grades, 120 mesh, \$22.
 Glassmakers', 30-100 mesh, \$19.

In Maryland:
 No. 1 body spar, 120 mesh, \$17.
 Enamellers' grade, 80-100 mesh, \$15.
 Glassmakers' grade, 30-100 mesh, \$13@\$15.

In Canada, f.o.b. mine:
 Crude, No. 1, over 12½ per cent potash, less than 5 per cent SiO₂, \$7.25 @\$7.50 per net ton.

Crude, No. 2, 20 to 25 per cent SiO₂, \$5@\$5.50 per net ton.
 Ground, No. 1, 180 mesh, \$20 per net ton, bags included.

Ground, No. 2, 180 mesh, \$15 per net ton, bags included.

Fluorspar—F.o.b. Middle Western mines, per net ton:
 Gravel, not less than 85 per cent CaF₂, and not over 5 per cent SiO₂, \$16@\$19.
 Lump, No. 2, not less than 85 per cent CaF₂ and not over 5 per cent SiO₂, \$19.

Lump, No. 1, 95@98 per cent CaF₂, not over 2½ per cent SiO₂, \$30.

Ground, 95 to 98 per cent CaF₂ and not over 2½ per cent SiO₂, \$30@\$32.50 in bulk, \$37 in bags or barrels.

Acid lump, 98 per cent CaF₂, not over 1 per cent SiO₂, \$35@\$36.

Acid, ground, not less than 98 per cent CaF₂ and not over 1 per cent SiO₂, \$45 in bulk, \$50 in packages.

Market weak with several anxious sellers.

In Canada, 84@86 per cent CaF₂, less than 5 per cent silica, \$18 per net ton, f.o.b. mine.

Price furnished by Foote Mineral Co., Philadelphia.

Fuller's Earth—Per ton, f.o.b. Midway, Fla.:
 16 to 30 mesh, \$16.50.
 16 to 60 mesh, \$18.
 30 to 60 mesh, \$18.
 60 to 100 mesh, \$14.
 Plus 100 mesh, \$7.50.
 Powdered, imported, duty paid, \$23 @\$25 per ton.

Garnet—Per short ton:
 Spanish grades, \$60, c.i.f. port of entry.
 Domestic Adirondack, \$85, f.o.b. shipping point.

Canadian, \$70@\$80, f.o.b. mines.
Gilsonite—Per ton, f.o.b. Colorado:
 Jet asphaltum, \$36.
 Selects, \$33.

Seconds (ordinary grades), \$25.50.
Graphite—First quality, per lb.:

Ceylon lump, 7½@8½c.
 Ceylon chip, 6½@7c.
 Ceylon dust, 3@4½c.
 Market quiet.

Crude amorphous, \$15@\$35 per ton.
 Flake, No. 1 and No. 2 from New York, 12@30c.

Manufactured grades:
 Flake, 12@30c. per lb.
 Extra fine ground, 12@30c.

Medium fine ground, 5@14c.
 Facings, 5@8c.
 Amorphous, 5@18c. per lb.

Gypsum—Per ton, depending upon source:

Crushed rock, \$2.75@\$3.
 Ground, \$4@\$6.
 Agricultural, \$6@\$7.
 Calcined, \$8@\$16.

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

Iron Oxide (See Ocher)—Ground, 95 per cent through 200 mesh, Standard Spanish red, \$40 per ton.

Kaolin—See China Clay.
Lepidolite—\$20@\$30 per ton for ordinary grades. Nominal.

Limestone—Depending upon source, f.o.b. shipping points; per ton:
 Crushed, ½ in. and less, \$1.10@\$1.70.
 Crushed, 3 in. and larger, 90c.@\$1.50.
 Agricultural, \$1.50@\$5.

Magnesite—Per ton, f.o.b. California mines:

Calcined lump, 85 per cent MgO, \$35.
 Calcined ground, 200 mesh, \$42.50.

Dead burned, \$29@\$31, Washington.
 Dead burned, \$40@\$42, Chester, Pa.
 Caustic calcined, Grecian, \$50@\$51, c.i.f., New York.

Manjak—Barbados, in 1 to 5 ton lots:
 Grade "A," 6c. per lb.
 Grade "AC," 7c. per lb.

Grade "AA," fine, 8c. per lb.
 Grade "C," fine and lump, 9c.
 Grade "C," lump, 12c.

Mica—
North Carolina pries:
 Scrap, \$20 per net ton.

Sheet, per lb. No. 1 quality, clear:
 Punch, 1½ in., 7c.

1½ x 2 in., 18c. 3 x 4 in., \$2.40.
 2 x 2 in., 50c. 3 x 5 in., \$2.75.
 2 x 3 in., \$1.00. 4 x 6 in., \$3.50.
 3 x 3 in., \$2.00. 6 x 8 in., \$6.00

No. 2 quality per lb.:

1½ x 2 in., 15c. 3 x 4 in., \$1.30.
 2 x 2 in., 30c. 3 x 5 in., \$1.80.
 2 x 3 in., 60c. 4 x 6 in., \$2.40.
 3 x 3 in., \$1.00. Punch 6c.

Market very good. Prices strong. Demand for scrap improved.

Ground, 60 mesh, \$65 per ton.
 Ground, 80 mesh, \$70.
 Ground, 120 mesh, \$120.
 Ground, 140 mesh, \$125.
 Dry ground, roofing, \$30.
 Dry ground, 80 mesh, \$35.
 Dry ground, 100 mesh, \$67.50.
 Dry ground, 160 mesh, \$70.00.
 Roofing grade, 20 mesh, \$35.
 Roofing grade, 100 mesh, \$70.
 Market improving.

In New Hampshire:
 Washer and disk, \$320 per ton.
 Scrap, \$24 per ton.
 White, dry ground, f.o.b. New England mill:
 20 mesh, \$30 per ton.
 40 mesh, \$50.
 60 mesh, \$65.
 100 mesh, \$80.
 200 mesh, \$90.

Madagascar, amber, dark, free from iron, per lb., f.o.b. New York:
 No. 1.....\$1.80 No. 4.....\$0.50
 No. 2.....1.30 No. 5......20
 No. 3......85 No. 6......15

Monazite—Minimum 6 per cent ThO_2 , \$120 per ton.
Ocher—"Yellow Peruvian," \$25@\$30 per ton, Georgia mines. Market good.
Ozocerite—Per lb. in bags, New York:
 Black, 160 deg. melting point, 24@25c.
 Green, 170 deg. melting point, 26@30c.

Phosphate — Per long ton, f.o.b., Florida export prices:
 76@77 per cent, pebble, \$5.75.
 75 per cent, \$5.25.
 74@75 per cent, \$5.
 70 per cent, \$3.25.
 68 per cent, \$3.00.
 Market fair.

In Tennessee, per long ton:
 78 per cent lump, \$8.
 75 per cent hand-mined lump, \$6.75 @ \$7.
 75 per cent washed lump, \$7.
 72 per cent washed run of mine, \$5 @ \$5.50.
 65 per cent ground 95 per cent through 100 mesh, \$7 per short ton.

Potash—

	Bags	Bulk
Muriate of potash 80@85 per cent, basis 80 per cent.....	\$34.55	\$33.30
Sulphate of potash 90@95 per cent, basis 90 per cent.....	45.85	44.60
Sulphate of potash-magnesia 48@53 per cent, basis 48 per cent.....	26.35	25.10
Manure salt 30 per cent.....	19.03	17.80
Manure salt 20 per cent.....	12.55	11.00
Kainit 14 per cent.....	10.25	8.25
Kainit 12.4 per cent.....	9.75	7.75

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

For prompt shipment:
 5 per cent on minimum quantity of 50 short tons K_2O
 6 per cent on minimum quantity of 100 short tons K_2O
 7 per cent on minimum quantity of 300 short tons K_2O
 10 per cent on minimum quantity of 500 short tons K_2O

Prices are practically the same as for last year, with a slight change in the bulk quotations of two grades of manure salt.

Pumice Stone—Imported lump, 3@40c. per lb.
 Powdered, in bbl., 3@5c.
 Lumps, in bbl., 6@8c.
Pyrites—Tharsis, per long ton unit, c.i.f. U. S. ports:
 Furnace size, 13c. per unit of sulphur.

Run of mine, 12c. per unit of sulphur.
 Cinder from ore to remain property of buyers.
 Market a little more active.

Quartz Rock Crystals—Colorless, clear and flawed, pieces $\frac{1}{2}$ to $\frac{3}{4}$ lb. in weight, 30c. per lb. in ton lots.
 For optical purposes, double above prices.

Rutile—F.o.b. Virginia points, per lb.:
 Granular, 94@96 per cent TiO_2 , 12@15c.
 Pulverized, 100 mesh, 94@96 per cent, 17@30c.
 93 per cent TiO_2 , \$200 per ton, Florida.

Silica—Water ground and floated, per ton, f.o.b. Illinois:
 400 mesh, \$31.
 325 mesh, \$26.
 250 mesh, \$22.
 200 mesh, \$20.
 100 mesh, \$8.
 Other grades per ton:
 140 mesh, \$6.25.
 200 mesh, \$8.75.
 Packed in bags, f.o.b. Ottawa, Ill.

Quartzite, in Canada, 99 per cent SiO_2 , \$3 net ton.
 Glass sand, \$2@\$2.25 per ton; brick and molding sand, \$2@\$2.25. Dull.

Spodumene—\$20@\$30 per ton, depending upon lithium content. Nominal.

Sulphur—\$16@\$18 per ton for domestic, f.o.b. Texas and Louisiana mines; \$18@\$20 for export, f.a.s. New York.

Talc—Per ton, in 50-lb. paper bags, Vermont mills, carloads:
 Ground, 200 mesh, extra white, \$11@\$12, bags extra.
 Ground, 180 mesh, medium white, \$10.50@\$11.50, bags extra.
 Ground, 160 mesh, medium white, \$10@\$11.
 If packed in burlap bags, \$1 per ton less plus 15c. each for bags.
 Prices firm. Some abatement in demand between middle of March and middle of April, but marked improvement since.

In New York, double air-floated, including containers, per net ton:
 200 mesh, \$13.75.
 325 mesh, \$14.75.
 100 mesh, \$11, not air-floated.
 Demand good.

In California, \$20@\$30 per ton, ground.
In Georgia, powdered, per ton:
 Gray or yellow, \$8@\$10.
 Red or white, \$10@\$14.
 Market good for powders.
 White, \$12@\$15.
 Grayish white, \$8@\$10.
 Red, \$10@\$15.
 Yellow, \$8@\$10.
 Roofing, \$8@\$10.
 Market good.

Tripoli—Per short ton, burlap bags, paper liners, per minimum carload 30 tons, f.o.b. Missouri:
 Once ground through 40 mesh:
 Rose and cream colored, \$20.
 White, \$18@\$27.
 Double ground through 110 mesh:
 Rose and cream, \$17@\$25.
 White, \$19@\$30.
 Air-float through 200 mesh:
 Rose and cream, \$35@\$40.

*Price furnished by Foote Mineral Co., Philadelphia.

White, \$40.
 Good market during January, February, and March. Showing signs of weakness at present.
Zircon—Freight allowed east of Mississippi River:
 99 per cent, 6c. per lb., f.o.b. Florida.
 Powdered, 7c. per lb., f.o.b. Florida.

Mineral Products

Arsenious Oxide (white arsenic)—5½c. per lb. delivered. Quiet.
Copper Sulphate—4.65c. per lb.
Sodium Nitrate—\$2.67 per 100 lb., ex vessel Atlantic ports.
Sodium Sulphate—\$19@\$22 per ton, New York.
Zinc Oxide—Per lb. in bags:
 Lead free, 7½c.
 5 per cent lead sulphate, 6½c.
 10 to 35 per cent lead sulphate, 6½c.
 French, red seal, 9½c.
 French, green seal, 10½c.
 French, white seal, 12c.

Ferro-Alloys

Ferrocerium—\$7 per lb.
Ferrochrome—1 to 2 per cent carbon, 23c. per lb.; 4 to 6 per cent carbon, 11½c. per lb.
Ferromanganese—Domestic and foreign, 78@82 per cent, \$115 per gross ton. Spiegeleisen, 19@21 per cent, \$33 f.o.b. furnace; 16@19 per cent, \$32.
Ferromolybdenum—\$1.50 per lb. of contained molybdenum for 50 to 55 per cent grades.
Ferrosilicon—10 to 12 per cent, \$35.50 @\$39.50 per gross ton, f.o.b. works; 50 per cent, \$82.50@\$85 delivered.
Ferrotitanium—For 15 to 18 per cent material, \$200 per ton, f.o.b. Niagara Falls, N. Y.
Ferrotungsten—\$1 per lb. of contained W, f.o.b. works. Nominal.
Ferro-uranium—30 to 40 per cent U, \$4.50 per lb. of U contained, f.o.b. works.
Ferrovandium—Per lb. of V contained f.o.b. works:
 Open hearth, \$3.25@\$3.50.
 Crucible, \$3.50@\$3.65.
 Primos, \$3.65@\$4.
 Market active.

Metal Products

Rolled Copper—Sheets, 21½c.; wire, 15½c.
Lead Sheets—Full lead sheets, 10½c. per lb.; cut lead sheets, 10½c. in quantity, mill lots.
Nickel Silver—28c. per lb. for 18 per cent nickel Grade A sheets.
Yellow Metal—Dimension sheets, 19½c. per lb.; rods, 16½c. per lb.
Zinc Sheets—10c. per lb., f.o.b. works.

Refractories

Bauxite Brick—\$140@\$145 per M., Pittsburgh, Pa.
Chrome Brick—\$48@\$50 per net ton, f.o.b. shipping point.
Firebrick—First quality, \$43@\$46 per M., Ohio, Kentucky, Central Pennsylvania; second quality, \$36@\$40.
Magnesite—Brick, 9-in. straights, \$65@\$68 per net ton, f.o.b. works.
Silica Brick—\$40@\$42 per M. Pennsylvania; \$45@\$47 Alabama; \$49@\$51, Indiana.
Zirkite—Powdered, 80 per cent ZrO_2 , 3c. per lb.; 70 per cent, 2½c. per lb. Brick, straights, 80c.@\$1 each.

Company Reports

Magma Copper Co.

The Magma Copper Co. started operating its smelter the latter part of March, 1924, and on March 29 poured its first copper bullion. The net metal contents of the bullion produced from that date to the end of the year was 23,301,511 lb. of copper, 533,204.05 oz. of silver, and 7,588.52 oz. of gold. Net gain for the year was \$544,799.

The net cost of producing copper after deducting gold and silver values was 7.87c. per pound. This cost does not include any allowance for depreciation or interest, but includes all other fixed and general expenses.

The company realized an average price of 12.865c. per pound in excess of all commissions and delivery charges on all of the copper delivered to buyers during the year.

On Sept. 12, 1924, the company sold at \$35 per share 5,150 shares of its capital stock not required for conversion of its bonds. Of the proceeds of this sale \$115,023.74 was used to pay indebtedness incurred in calling \$105,000 face value of bonds which had been delivered to the trustee for cancellation on March 31, 1924.

Magma Copper Co. and Magma Arizona Railroad Co. Consolidated Balance Sheet, Dec. 31, 1924

Assets	
Total current assets.....	\$2,246,999. 98
Prepaid insurance and interest.....	27,829. 04
Investments in Sacaton Copper Co.—57,000 shares.....	68,043. 07
Investments, Apache Powder Co.....	10,200. 00
Mining property and railroad.....	5,313,961. 17
Bond discount and expenses, less amortization.....	141,766. 16
	\$7,808,799. 42
Liabilities	
Total current liabilities.....	\$2,112,490. 18
Ten-year 7 per cent convertible gold bonds.....	3,494,500. 00
Reserve for casualty insurance.....	\$146,342. 63
Capital	
Common stock: Issued 245,165 shares.....	\$1,380,750. 00
Surplus.....	674,716. 61
	\$7,808,799. 42

During the three months ended March 31, 1925, there was produced by Magma Copper Co., 6,819,220 lb. of refined copper at a cost of 6.38c. per pound after deducting gold and silver values. This cost does not include allowance for depreciation or interest, but includes all other fixed and general expenses. The net earnings for the same period before deducting depreciation and interest were \$518,356.03, based on a net sales price of 13.986c. per pound of copper.

Copper Range Co.

The 1924 report of Copper Range Co. shows a deficit of \$476,101 after all charges as follows:

Gross Income	
25,109,175 lb. of copper produced and sold at average of 13.76c. per lb.....	\$3,455,575. 21
Copper Range Ry. operating revenues.....	920,745. 21
Interest.....	190,723. 45
Atlantic Mining Co.....	6,186. 39
Total.....	\$4,573,230. 26
Deductions	
Mining expense, smelting, freight, taxes.....	\$3,078,005. 23
Copper Range Ry. operating charges.....	761,794. 56
One-half Champion profits belonging to St. Mary's Mineral Land Co.....	354,638. 26
	4,194,438. 05
Operating profits.....	\$378,792. 21
Interest on Copper Range Ry. first-mortgage bonds.....	114,000. 00
	\$264,792. 21
Net income.....	740,893. 38
Depletion and depreciation for two and one-half mines.....	\$476,101. 17
Deficit.....	\$476,101. 17

Current Assets and Total Liabilities, Dec. 31, 1924

Assets	
Current assets.....	\$6,341,665. 55
Liabilities	
Current indebtedness at mines.....	\$119,152. 78
Accounts payable.....	44,559. 69
	163,712. 47
Less one-half Champion.....	\$6,177,953. 08
	1,273,005. 68
Net excess of assets.....	\$4,904,947. 40

Kennecott Copper Corporation

Copper; Alaska

After making allowance for depreciation at all the plants and also charging off all taxes (but before depletion), the earnings of the Kennecott Copper Corporation for 1924 from its own operations and including its proportionate share of the earnings of the various companies whose securities it held Dec. 31, 1924, amounted to approximately the same as for the year 1923—\$5 per share. Production for shipment to smelter, 61,615 tons, containing 42,526,500 lb. of copper.

Kennecott ores milled totaled 99,240 tons, yielding 15,773 tons of concentrates, assaying 39.2 per cent copper. The leaching plant produced 1,592 tons of precipitates, containing 1,171 tons of copper. The total recovery of copper in all ores treated in milling and leaching was 92.44 per cent.

The mill at Latouche treated 479,915 tons, assaying 1.704 per cent copper. Concentrates produced amounted to 29,959 tons, with a copper tenor of 23.78 per cent. Recovery for the year was 87.08 per cent.

Cost of producing copper during the year, delivered to consumer, after charging in depreciation and taxes and crediting silver and miscellaneous earnings, but before depletion, amounted to 9.11c. per pound.

Balance Sheet as of Dec. 31, 1924

Assets		
Mining property.....		\$9,817,871. 69
Construction and equipment.....		359,690. 01
Investments		
1,435,839 shares Utah Copper Co. stock.....	\$104,472,355. 97	
2,582,792 shares Braden Copper Mines Co. stock.....	39,987,487. 48	
38,394.325 shares Alaska Steamship Co. stock.....	4,202,937. 50	
500 shares Alaska Development & Mineral Co. stock.....	62,480. 03	
48,174 shares C. R. & N. W. Ry. Co. stock.....	1. 00	
\$23,020,000 par value C. R. & N. W. Ry. Co. bonds.....	14,408,608. 34	163,133,870. 32
Current and working assets.....		25,542,017. 02
		\$198,853,449. 04
Liabilities		
Capital stock and surplus.....		\$171,424,765. 68
Notes payable.....		12,000,000. 00
Accounts payable.....		729,975. 24
Earned surplus (after depletion).....		14,698,708. 12
		\$198,853,449. 04
Income Account		
Operating revenue:		
Copper sold—42,985,532 lb. @ 13.342c.....	\$5,735,056. 78	
Silver sold—326,578. 13 oz. @ 66.869c.....	218,380. 24	
	\$5,953,437. 02	
Operating cost.....		4,080,904. 42
		\$1,872,532. 60
Income from miscellaneous operations.....		35,525. 79
Profit on metals sold.....		\$1,908,058. 39
Other receipts.....		10,383,017. 67
Total income for year.....		\$12,291,076. 06
Deduct		
Interest and discount on bonds and notes.....	\$1,197,500. 00	
Taxes.....	215,612. 65	
	1,413,112. 65	
Balance to earned surplus.....		\$10,877,963. 41
Earned Surplus		
Balance as stated Dec. 31, 1923.....		\$14,729,645. 09
Income for year.....		10,877,963. 41
		\$25,607,608. 50
Depreciation.....	\$249,492. 96	
Depletion.....	2,006,972. 09	
Discount and premium on bonds redeemed.....	1,293,750. 00	
Capital distributions from Utah Copper Co.....	5,070,898. 59	
	\$8,621,113. 64	
Dividends (but not including capital distributions amounting to \$9,552,918. 85).....	2,287,786. 74	10,908,900. 38
Balance of earned surplus, Dec. 31, 1924.....		\$14,698,708. 12

American Metal Co., Ltd.

The American Metal Co., Ltd., reports for the first quarter of 1925 net profit of \$755,326 after charges, or after preferred dividends \$1.12 per no par common share, compared with \$899,373, or \$1.37, for the same period in 1924.

Mining Stocks—Week Ended May 2, 1925

Table listing mining stocks with columns for Stock, Exch., High, Low, Last, and Last Div. Includes sections for COPPER, NICKEL-COPPER, LEAD, ZINC, GOLD, and SILVER.

Table listing mining stocks with columns for Stock, Exch., High, Low, Last, and Last Div. Includes sections for GOLD AND SILVER, SILVER-LEAD, IRON, VANADIUM, ASBESTOS, SULPHUR, DIAMONDS, PLATINUM, MINING, SMELTING AND REFINING, and LONDON QUOTATIONS.