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By Felix Edgar Wormser

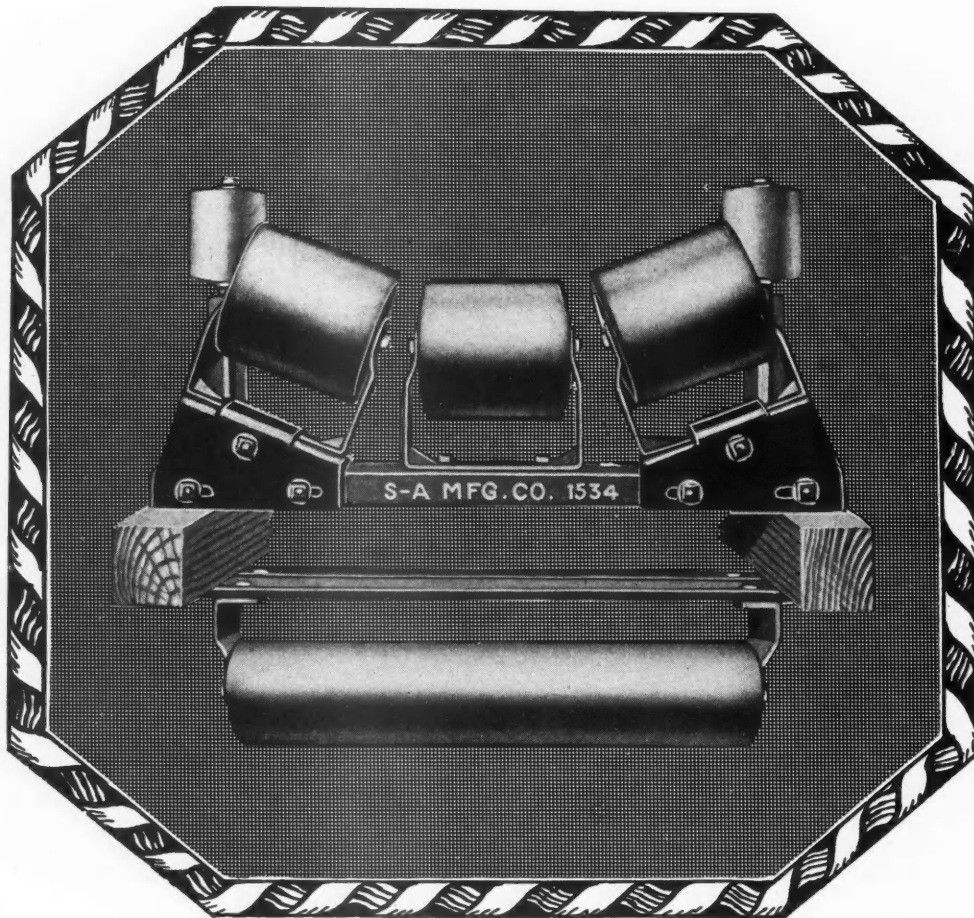
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A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

October 28, 1922



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The Future Silver Market

THE ACUTE WORK of Dr. Pailhas on silver, which we review on page 775, carries the study of the silver market only to the end of 1921, although the volume was published in 1922. Speaking for the period at the end of last year, Dr. Pailhas points out that the absorption of silver produced in the United States for two years by the United States Government is a factor supporting the market, but that there are other and unfavorable factors. Stocks of silver have accumulated. "Besides, the demand for silver is much reduced. Industrial consumption suffers from the economic crisis; the coinage of silver has practically ceased, and until exports of commodities from India shall have reached their former activity, we can expect neither a lasting rise in the price of silver nor even perhaps its maintenance at the present level."

Since this opinion was written, the world price of silver actually sank, in February-March, 1922, but rose with the general rise in the price of other metals, such as copper, lead, and zinc, with the increased general commercial prosperity which manifested itself in the spring. In May, however, a slow sagging of silver prices began, which is still evident, although during these months the lead and zinc markets have been buoyant, and even the laggard copper market maintained and consolidated its rise for many months.

The decisive factor in the relative price of silver appears to be its use in coinage, and the predominant element in this coinage factor is the condition of trade in India and China, with their 700,000,000 of people who have little respect for paper money and are not rich enough to trade with gold. The ability of these countries to amass wealth in the current form of silver depends upon their balance of trade, upon their exportation of commodities to other countries. In the fiscal year 1920-21 the normally favorable trade balance of India was changed into an unfavorable balance. In China, the trade balance is normally unfavorable—imports exceed exports—but in 1920 was phenomenally so.

The miner of silver, and the prospective miner who is contemplating mining silver for some years to come, is, unlike the gold miner, primarily concerned with the market. He will observe to how phenomenal a degree his success will depend upon peace, prosperity, and production in the Far East. He will note that the present disturbed political conditions in the Far East and in Europe are a factor unfavorable to a great demand for silver for rupees or taels or pesos. It is likely that for years to come Europe will conserve the economies which she has instituted in the coinage of her fractional currency—the use of a depreciated standard of silver coinage or of substitutes of other metals, or, in part, of fractional paper currency. There is also the possibility, if the Orient prospers exceedingly, that silver will be gradually replaced by gold, a movement which was already

well in progress in India when the war broke up all regular movements.

That the United States production of silver will have to compete, according to all probabilities, in the world market after or even in the last part of 1923, is of course a depressing factor in the estimation of the price of silver from now on for several years. Various devices have been proposed to maintain in some degree the wall of defense to the silver markets of the United States which the purchases by the United States Government under the Pittman Act now forms. It has been proposed to organize a Silver Export Association, under the Webb Act, to market scientifically abroad, as is done by the Copper Export Association. This suggestion is worthy of consideration, but while the United States has been producing about 60 per cent of the world's copper, and has controlled commercially about 70 per cent, it has produced only about 30 per cent of the world's silver, so that only a Pan-American combination or trust would really be powerful—and that is altogether unlikely ever to be attempted or realized. Such a combination is, however, actually being suggested and considered. But its task would be gigantic, for in the long run it would be powerless to increase the world consumption of metal, and its only method of maintaining high prices would be to limit the production, as is done by the African diamond syndicate. This artificial limitation, again, even if it were practically possible, would not spell general prosperity for the industry in general, with its many and diverse elements.

The Conflict of Romance and Industry

APPLES constitute the chief product of the Shenandoah Valley of Virginia, but the production of caves is rapidly advancing toward first place. Quite recently the Endless, the Shenandoah, and various other caverns have been made accessible to the public, and supply a new attraction for tourists. Their natural beauties, enhanced by skillful artificial lighting, afford a spectacle well worth the traveler's time to pause by the wayside, and the curious forms resulting from solution and redeposition provide an interesting geologic study for those so inclined. Cave exploration, both by prospective cave proprietors and by the sight-seeing public, has become a pastime in the valley, a recreation that may bring the satisfaction of monetary gain to the former, and the joy of spending to the latter. Thus the freaks of nature are utilized to develop lucrative enterprises.

There is another side to the question, however—an aspect less attractive, where the same phenomenon of nature presents a barrier to industry that may reach proportions almost insurmountable. Certain beds of limestone in the Shenandoah Valley are very pure, and are utilized extensively for the manufacture of high-

grade lime. Many of the limestone quarries are of wide extent, and have been carried to depths exceeding 100 ft. The seeker of caverns would expect these excavations to furnish a happy hunting ground where numerous mysterious caves might be uncovered, while the lime manufacturer prefers to find no caves at all, his interest being centered in sound and continuous deposits of pure limestone. The rock in many localities is, in fact, literally honeycombed by erosion, but occasionally only is an open cave found, the cavities being filled with sticky red clay. Such clay pockets and seams are very numerous, and some of them extend to depths of 60 or 80 ft. It is necessary in the manufacture of pure lime that practically all clay be separated from the limestone, and, where clay and rock are so intimately associated, such separation is a difficult and costly process. Much of the clay is removed by slow and laborious methods. The stripped rock surface is extremely rugged, consisting of pinnacles and domes of limestone with erosion cavities between them.

It is a curious fact that erosion cavities which may provide romantic galleries and halls, through which pass the echoing footsteps of countless travelers, may in near-by places assume forms that constitute a serious detriment to a great essential industry. Thus do romance and industry conflict.

Suffrage for Geologists

AN AMENDMENT is being proposed to the constitution of the Geological Society of America whereby the selection of officers shall be taken from the council of the society and transferred to the direct vote of the fellows of the society. The past practice has been for the council to select the new officers such as the president, and thereafter send out a mock ballot to the fellows of the society, this ballot bearing the name of only one nominee for each office. After these ballots have been sent out, and, it may be assumed, some gravely returned, the one selected nominee for president is ceremoniously declared elected by the vote of the society, and is puffed up with pride, we may imagine, at the regard universally shown him by his fellow craftsmen.

The new amendment proposes that nominations for office shall be made by the fellows of the society through a primary vote; that as a result of this vote the two members receiving the highest number of votes for each office shall be declared nominees and the final election shall decide between these two nominees.

It is much to be hoped that the proposed amendment will be adopted, and the new method used. It will require a favorable vote of three-fourths of the members. In restricted societies the theory that a little clique shall govern because its intelligence and judgment are superior to those faculties of the rest of the members of the society is a vain and silly one. Analysis in typical cases shows that it is by no means true that the governing oligarchy is of finer clay than the other members. Societies of the highest grade are more and more discarding the antiquated methods of boss rule and are exercising the right of suffrage. Their officers are elected, not tagged. The Geological Society of America is such a select body—each man fit to vote and responsible for his share of the conduct of his society. We hope that no president will accept office in the society unless he be duly elected.

A New Nevada Enterprise

A FEATURE of the recent visit of the American Institute of Mining and Metallurgy to San Francisco was the opportunity afforded to the members to visit Gold Hill and Comstock, a new mining village upon the historic American Flat in the Virginia City district. Bulkeley Wells and his associates received the members of the Institute and many Nevadans upon the occasion of the initiation of milling operations by the United Comstock Mines Co. This company acquired the Gold Hill group of mines upon the southern portion of the Comstock Lode and systematically developed the property. A milling plant, the largest ever constructed in western mining districts for gold and silver recovery, had just been completed and was ready for operation for the first time.

The occasion was a significant one. There was enthusiasm on the part of the Nevadans. There was a quiet determination on the part of the members of the company's staff of engineers. The workmen finishing up parts of the plant scarcely missed a stroke as the visitors wended their way in groups through the plant. Not a detail was overlooked. Signs with arrows pointed the way, and runways, protected with ropes where necessary, prevented accidents. Courteous guides answered innumerable questions. A special train was arranged to take a hundred or more through the adit and into the mine workings.

William Sproule, president of the Southern Pacific R.R. Co., summed up the psychology of the moment when he said that the pathetic city of the past had become the prophetic city of the present. Virginia City has been dead for many a year. Hydro-electric power, the hydraulic elevator, and the Riedler pumps revived it for a while. Charles Butters gave the game a whirl, but lost \$500,000 and retired to less difficult fields. Ore discoveries in the Northend resulted in the construction of the Mexican mill, a small 100-ton plant. Leasers worked here and there. Several companies tried the Yellow Jacket, but eventually retired, although a 200-ton concentrating mill worked for a long time upon the old waste dumps. Many of the efforts made since 1898 were upon a small scale, excepting only the drainage work and the attempt to reopen the Ward shaft. The Ward shaft was lost. Deep drainage was stopped. It would be difficult to find a similar series of efforts resulting in such scanty success, but in spite of this the various operations sent out a modest stream of bullion year by year.

In the light of the many failures, it required real courage and nerve to investigate the traditions of the existence of large bodies of low-grade ores. Nevertheless, be it said to the credit of the mining industry, men were found who had the nerve and who had the confidence of financiers, and were therefore able to command the capital to first investigate and finally to put a princely sum into the necessary development and plant to mine and mill over 2,000 tons of low-grade ore per day.

Men like Bulkeley Wells and the financiers who have intrusted their wealth to him are important sinews and nerves of the mining industry. Without them an enterprise like this could never have been started. We extend our cordial well wishes for the success of the new Comstock enterprise, and congratulate Bulkeley Wells, his staff of engineers, and—yes—even his boarding-house managers, upon the work that they have so ably begun.

Motor Alcohol in the Philippines

A CORRESPONDENT writing from the Philippines refers to our editorial of June 10 on "Substitutes for Gasoline," and calls attention to the manufacture of motor alcohol in the Philippines. We quote the following from his letter:

"No doubt you are not familiar with the progress that has been made in the converting of molasses into motor alcohol, which is going on extensively in the Philippines. One of the byproducts of a cane sugar mill is waste molasses, of which there is a very large quantity, which would be an utter loss were it not for the fact that a process is being used to convert this waste material into a useful and profitable article of commerce.

"I wish to correct your statement that 'The efficiency of the spirit is not so high as that of gasoline, but, according to reports, no damage to motor parts has resulted.' The efficiency of the motor alcohol has proven greater than gasoline, and after a test of 300 continuous hours, the parts examined were found to be in better condition than the same test with gasoline. The deposit of carbon was almost nil, and the quick response to the alcohol was very much greater than gasoline."

Our correspondent writes that gasoline in the Philippines is sold for P. 1.05 per gallon, and that motor vehicles and tractors are using motor alcohol to a very large extent. In converting the molasses into motor alcohol, the potash is returned to the soil as a fertilizer.

The Manganese Problem

WE CALL ESPECIAL ATTENTION of engineers and managers of manganese mines, active or prospective, to the communication from Mr. C. M. Weld in our Discussion department. Co-operation should be most heartily extended to this committee, as to the committees on the other metals which have been appointed under the same general plan. The Committee on Military Preparedness of the American Institute of Mining and Metallurgical Engineers, appointed at the request of the War Department, is co-operating with the Committee on Foreign and Domestic Mining Policy of the Mining and Metallurgical Society of America, in the endeavor to ascertain the basic facts concerning our mineral supplies, upon which basic facts a sound program for war or peace can be reared.

The subcommittee on manganese, which serves as a subcommittee of each of the above-named general committees respectively, and which speaks in the communication on page 753 through its chairman, Mr. Weld, is one of the first to take the field in the campaign to ascertain the facts. This committee represents directly the American Institute of Mining and Metallurgical Engineers and the Mining and Metallurgical Society of America; it represents the War Department, the Bureau of Mines, and the Geological Survey. Nevertheless, it starts its investigations with no preconceived opinion which will be allowed to hamper it in its progress. Its first and largest problems will be to estimate American manganese reserves and American manganese consumption. This is typical of the other committees which will begin work on "strategic" minerals. A difficult and weighty task at the best, this volunteer activity on the part of the committee should be supported by the voluntary co-operation and assistance of engineers all over the country. It is a purely patriotic undertaking, and assistance should be rendered in this lofty and sober spirit. Engineering accuracy, engineering standards, impartial weighing of evidence, will make this work a

success and mark a beginning in the greatest contribution that mining engineers and geologists have ever had the opportunity to make toward sound and beneficial national policy.

Non-Metallic Market Prices

OWING largely to the widely scattered small units in the non-metallic mining industries, and to the disorganized states of some of them, the task of accurately quoting prices of non-metallic products is at best beset with many difficulties. *Engineering and Mining Journal-Press* is the only periodical in the world regularly furnishing comprehensive quotations covering the principal non-metallic mineral products of the United States and other countries. A few journals publish the prices of some special non-metallic group, such as paint pigments, but no other medium attempts to cover the whole field. The initiation of this service to our readers was attended with much reluctance on the part of a few mineral producers and consumers to supply dependable figures. We also had trouble in securing reliable market correspondents. However, unstinting support by the large majority of companies to which we appealed soon produced the desired result. In fact, today we find, now and then, unsolicited offers of assistance in obtaining quotations and suggestions as to how our non-metallic market service might be improved, all of which are very welcome.

In furnishing the non-metallic industries with reliable quotations we are endeavoring to supply a deficit in the marketing of those commodities that has affected and should affect the miner's pocketbook—the lack of a market place and definite prices. Our attention more than once has been called to the advantage which a large consumer of a non-metallic mineral has taken and can take in the absence of an index to price in that particular mineral, by his superior knowledge of market conditions. The miner generally must rely on limited information in obtaining an impression of what constitutes a fair price for his product. Hence it is of the utmost importance to the non-metallic miner to have a source to which he can quickly refer when in doubt about the market. This fact is being realized more and more by various non-metallic producers. Two of them—each mining a different mineral—approached us recently with an offer of financial assistance to widen the scope of our market survey in the non-metallic in which they were especially interested. We naturally must decline such offers, helpful as they are, so as to remove all shadow of doubt that our surveys and market analyses are free of bias. At the same time, we wish to thank the many mineral producers, dealers, and others who have been, and are, co-operating with us in this work.

Although the market summaries as they stand represent the result of the co-operation of many valued contributors, we are ever anxious to increase their number, and to this end would urge those producers and consumers whom we have not reached to get in touch with us on the subject. Our plans contemplate widening the scope of the quotations we make to include mineral commodities not listed at present—such as the mineral hydrocarbons—which we hope to do with the aid of those of our readers who produce these commodities. The marketing of the rarer non-metallics is often highly irregular, which makes it difficult to quote a continuous market.

The Tellurides—II

BY T. A. RICKARD

WHEN I was in Western Australia in 1897 the notion prevailed that the discovery of tellurides indicated persistence, that is, the veins containing them would continue in depth farther than those in which the gold existed in the more ordinary state of native metal in a quartz gangue. The chief proponent of this glittering generalization was a so-called mining expert rejoicing in the euphonious name of Modeste Maryanski. The suggestion put forward by him, that the presence of tellurides was a sure sign of persistence of ore in depth, was promulgated eagerly by the numerous charlatans and wild-cat promoters who infested the West Australian desert at that time. Some talk of the same kind was not unknown during the Cripple Creek boom. In neither of these two districts, nor elsewhere, have telluride ores been characterized by special continuity in depth; on the contrary, in older telluride districts, in Transylvania and Colorado, the miner's experience pointed the other way, and it was generally held among those who were aware of the facts that telluride veins were erratic in behavior and comparatively non-persistent. Later and wider experience warrants the statement that the presence of tellurides in a gold vein or a silver lode carries no sinister implication nor does it justify more than the healthy optimism essential to successful mining—in short, no prediction as to persistence is permissible.

As an example of current ideas, I may refer to newspaper accounts of a discovery said to have been made on the Comstock last year. One dispatch was headed "A tellurium ore strike". It was described as "the largest body of tellurium ore ever found in Nevada", and "the finding of this metal in such an orebody" was considered of "unusual significance" because "tellurium is usually associated with high-grade gold ore". Thus is misinformation disseminated by the daily press, which disdains the trouble of making inquiry among those well informed on technical matters. The occurrence of a telluride, which is what "tellurium" means in the passage quoted, is credited with sundry favorable inferences probably by reason of the fact that in 1907 the rich ore of the Combination mine—later a part of the Goldfield Consolidated property—contained a telluride of the precious metals, probably calaverite. Thus the association of a telluride with bonanza ore at Goldfield may have revived the old fallacy in Nevada.

There is no need for guessing at the presence of a telluride, because it can be detected by means of a simple test. The experiment is a beautiful one. Take a speck of the suspected mineral and place it in a porcelain dish or white saucer; add a drop of strong sulphuric acid; heat the acid over a bunsen burner or a spirit lamp; if tellurium is present a beautiful carmine suffuses the colorless acid. If the tellurium is intimately associated with other minerals, it may be necessary to make a more elaborate test. Grind the mineral fine; take a pinch of the pulp and treat it with strong nitric acid in a porcelain dish, using heat until the material is thoroughly oxidized; then add strong sulphuric acid and heat again until the excess of nitric acid is expelled or until copious fumes of sulphuric acid are given off. When cold, add hydrochloric acid

and water in equal proportions, then filter, and to the filtered solution add stannous chloride, which will produce a black precipitate if tellurium is present.

The miner's time-honored test is to put the specimen of ore in the fire of a blacksmith's forge, where it is 'sweated', or roasted. The tellurium is driven off as a white fume of telluric oxide and the gold remains in yellow globules; if more gold telluride be hidden in the cracks within the specimen it will be exuded as a yellow perspiration. This test suffices for an ore that is rich in tellurides, particularly of the precious metals, but it fails when applied to some of the other tellurides, such as those of bismuth and mercury. If coloradoite, the telluride of mercury, be subjected to the sweating test, the mercury will volatilize readily and pass off as fume when the rough assay is made. A simple test for the mercury telluride is to heat a particle in a glass tube held at a slant, so that any mercury, if liberated, may condense into metallic globules at the upper and cooler end of the tube. It must be noted also, in making the sweating test, that if the gold is associated with mispickel, or arsenical pyrite, it will collect in globules, but the white fume escaping from the heated ore will smell strongly of garlic—the sign of arsenic—whereas tellurium carries the smell of horse-radish.

The assaying of telluride ores presented difficulties at one time, particularly on account of the loss of gold during cupellation. It was supposed at first that losses were due to the volatilization of the tellurium, which dragged some of the gold with it, but later it was ascertained that the loss was caused by the absorption of the gold by the bone-ash of the cupel itself. This is due to insufficient lead and excessive heat. Most of the authorities on assaying recommend the crucible method in preference to scorification; they advise slow fusion and the formation of a basic slag. It is advisable to use plenty of litharge or red lead, because the loss in cupellation depends upon the ratio of lead to tellurium in the lead button. A preliminary scorification of this large lead button is advantageous.

Formerly—twenty years ago—it was supposed that telluride ores were refractory; they were regarded as difficult to treat by any smelting operation. That was true when roasting was conducted in a crude manner, because during the roasting the tellurium is not driven off with the sulphur, but, as soon as it has volatilized, which it does readily, it becomes oxidized to TeO_2 and is fixed in the roasted charge by combining with the oxide of iron that is formed from the pyrite in the ore. What tellurium does escape, and is found subsequently in the flue-dust, is carried away mechanically by the draft. Richard Pearce made the laboratory tests that elucidated this matter; he ascertained that as much as 96% of the tellurium remains in the roasted ore. The tellurite of iron thus formed, in the furnace by roasting or in nature by oxidation, has a light-brown color and a bright yellow streak. I found some of it in a specimen at Kalgoorlie. As a mineral it has only an academic interest, but the chemical reactions of which it is the result play an important part, as we have seen, in the roasting of telluride ores. In my next article I shall give a detailed description of these ores.

DISCUSSION

Domestic Manganese Resources

THE EDITOR:

Sir—At the request of the Secretary of War, a thorough examination of our domestic resources of several metals essential to the carrying on of war, as well as of vital importance in times of peace, has been undertaken by the American Institute of Mining and Metallurgical Engineers, co-operating with the Mining and Metallurgical Society of America. The presidents of these two societies have created several joint subcommittees; among others a subcommittee on manganese.

It is the purpose of this manganese committee to attempt a careful survey of our domestic manganese resources and to study these resources in their relation to both peace and war needs.

The value of the results of this investigation will necessarily depend upon the quantity, accuracy, and degree of detail of the data that can be obtained. It is desired, therefore, to make use of every available source of information. Many manganese deposits throughout the country have been examined by engineers and geologists since 1917, and many reports have been printed. There must be many additional reports in the hands of engineers of mining companies and of owners which might be made available to the committee. The committee will be glad to consider summaries of estimated reserves for districts, but particularly wishes detailed reports on separate mines or deposits with maps (if possible), records of shipments (if any), representative analyses, prospecting records, and other data.

All those sending in such reports and other pertinent information will assist the two societies in performing an important public service. Material submitted to the committee will be treated as confidential if it is so requested, and after examination will be returned. If original material cannot be sent, the committee will be glad to furnish blanks indicating the more essential details which are desired. Send material or write at once to C. M. Weld, 2 Rector St., New York, N. Y.

SUBCOMMITTEE ON MANGANESE

C. M. Weld, Chairman

D. F. Hewett

Bradley Stoughton

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New York.

A Working Library for a Mining Engineer

THE EDITOR:

Sir—Early last spring I had occasion to make up a list of books to be used as a reference library by a young mining engineer working in a foreign country where there was nothing of the kind obtainable. The books were to cover the field of mining engineering as completely and broadly as possible and at the same time the number and weight of the volumes were to be kept as low as feasible. The list as first compiled contained some blanks and was sent to the Editor of the *Mining and Scientific Press*, who kindly suggested the additional volumes.

In your issue of Aug. 5, 1922, Mr. Rickard suggests a "four-foot shelf of books" for a "working library for a mining engineer." From a footnote I assume that the list is what Mr. Rickard recommended to the graduating class of the New Mexico School of Mines as "trustworthy friends to those engaged professionally in the application of scientific knowledge to the art of mining." The use of the word "working" and Mr. Rickard's opening paragraph would indicate that we are both aiming at the same thing.

Mr. Rickard's list, as published, might be suitable for some special cases, but it is entirely inadequate for the conditions I originally had in mind and does not seem to cover the ground necessary for a young mining engineer. Many fields and subjects which have to be consulted continually are not even touched upon. In one or two cases there are certainly more modern books than the ones chosen. I fear that the last statement applies to some of the titles in my list.

Mr. Rickard has suggested several volumes for their cultural value. This is aside from the original purpose of my list, and it seems to me that such a choice could well be left for a separate discussion. From a cultural point of view the average individual could not well improve on the "Harvard Classics," and if that is too long, individual taste and need would decide on what to eliminate or add. I was surprised to see so critical an editor choose the St. James version of the Bible. If the Bible is to be included I would expect Mr. Rickard to pick such an edition as the Moulton, which is well edited. Wells' "Outline" is another surprise. Although it is a wonderful work, the second volume particularly puts it into the class of books that I call "argument starters," and I venture to say that when read by most mining engineers, particularly if they are operators, its cultural value is lost in a sense of exasperation. If Wells, why not "The Passing of a Great Race"? "The Origin of the Earth," by Chamberlin, or some such book would fit in much better. As for poetry—even money cannot hire 10 per cent of the miners to read Manly. Most of us would get more kick out of Kipling or Burton Braley.

In Mr. Rickard's technical list "Surveying" and "Computations" are left out, possibly as being too elementary, but assaying is included, and an indifferent book at that, though I know of no better. There is no lithology, as such, in his list. Pirsson and Schuchert's "Geology" is taken, possibly to save space, but the additional weight of Dr. Grabau's two volumes and Kemp's "Handbook" is certainly well worth while, as the ground is completely covered from the latest and most modern point of view. A general chemistry is essential. Morrison's "Mining Rights" is superfluous in a foreign country, but in the United States the additional size and weight of Lindley is warranted, if for no other reason than its index. Equipment, construction, iron, steel, coal, and general metallurgy are some of the essentials that have been left out. The choice of Clennell's "Cyanide Handbook" and Rickard's "Concentration by Flota-

tion" might be questioned for not being as up to date as Julian & Smart's Third Edition and Taggart's "Manual." Gunther's "Prospecting" could well be substituted for Stretch, but both can be eliminated, as the ground is covered in other books that in no case would be omitted. A most serious omission is a good catalog of mine supplies and equipment such as the Keystone. I venture to say that 90 per cent of the operators would insist on a book of this kind being included. Unfortunately, the Keystone catalogs are in inconvenient volumes, but at that the need gives them a place.

The list I would suggest is:

Peele, "Mining Engineer's Handbook."
 Ford, "Dana's Manual of Mineralogy."
 Kemp, "Handbook of Rocks."
 Johnson, (?) "Surveying."
 Vega, "Log. Tables."
 Remsen, (?) "General Chemistry."
 Furman, (?) "Assaying."
 Lowe, "Quantitative Chemical Analysis."
 Liddell, "Metallurgists and Chemists' Handbook."
 Slosson, "Creative Chemistry."
 Grabau, "Comprehensive Geology."
 Lindgren, "Mineral Deposits."
 Spurr, "Geology Applied to Mining."
 Leith, "Economic Aspects of Geology."
 Richards, "Text Book of Ore Dressing."
 Julian and Smart, "Cyaniding of Gold and Silver Ores."
 Taggart, "Manual of Flotation."
 Austin, (?) "Metallurgy of Common Metals."
 Hoffman, "Metallurgy of Copper."
 Johnson and Huntley, "Oil and Gas Production."
 Eckels, "Iron Ores."
 Howe, (?) "Metallurgy of Iron and Steel."
 Howe, (?) "Coal and Coke."
 Young, "Mining Methods."
 Hoover, "Principles of Mining."
 Finlay, "Cost of Mining."
 Storms, (?) "Timbering and Mining."
 Dana, "Handbook of Construction and Equipment."
 Hoskold, "Engineer's Valuing Assistant."
 McGrath, "Mine Accounts and Cost Principles."
 Haskill, "How to Make and Use Graphic Charts."
 Rickard, "Technical Writing."
 "Keystone Mining Catalog."
 Weed, "Mines Handbook."
 Fay, Glossary, U.S.G.S. Bulletin 95.
 Webster's Collegiate Dictionary.

This list, though incomplete, is the most satisfactory I have been able to compile so far. I feel that the volumes preceded by a (?) could be improved upon particularly. There are some gaps that should be filled. Ingalls' "Lead" should almost surely be added, as well as some book on the non-metallic minerals and their industries. Emmons' "Geology of Petroleum" could well be added, but Johnson and Huntley could not be left out unless another volume covering oil and gas production and operations was substituted. The Simmons-Boardman Material Handling Cyclopedic might well be included. Inwood's "Tables" might be substituted for Hoskold's "Valuing Assistant" and Hatfield's "Modern Accounts" for McGrath's book. For use in the United States a volume on the income tax should be added.

My list is somewhat longer than Mr. Rickard's, but it will go into a five-foot box with a small margin to spare. Mr. Rickard may have felt that great condensation was necessary, but in so doing he has killed the value of the suggestion by carrying it to an extreme.

It was my hope originally that a list might be obtained in which enough interest would be shown to make it worth while for some publisher to put it out as a unit.

Los Angeles, Calif.

WEBSTER WICKES.

Fire Protection at Calumet & Hecla

THE EDITOR:

Sir—Because of the recent disaster at the Argonaut, it may be of interest and possibly of some value to know how knowledge of an underground fire is conveyed to the men in the mines of the Calumet & Hecla and associated companies.

Tees of the same size as the main air pipe are placed in the main line at the collars of the shafts. When an underground fire is reported these valves are opened immediately, all compressors are stopped, and the air pressure drops to zero in a very few minutes. This is our standard fire signal, and underground men who notice that the air pressure has dropped are instructed to notify the other workmen in their vicinity and to report at once at the shaft. Bosses are responsible for all men under their supervision. At the beginning of the shift few men are drilling, but some of them are "blowing" air to remove powder fumes, and others are operating air hoists, scraper engines, air lifts, and other equipment. It is expected that enough of these men will get the signal to carry the word to the others. During the greater part of the shift—when most of the miners are operating machine drills—the release of the air is noticed almost everywhere. Men working in isolated places, and not using compressed air at the time, are notified by bosses or by men sent for that purpose. Fire drills are held occasionally—once in from one to three months. Everyone must report at the shaft and be checked off before returning to his working place. The results have proved the method remarkably effective—even at the great depth and in the extensive openings of the Calumet & Hecla conglomerate shafts.

Ahmeek, Mich.

OCHA POTTER,

Superintendent Ahmeek Mining Co.

California Mine Safety Organization

THE EDITOR:

Sir—Statements made by H. Foster Bain, Director of the U. S. Bureau of Mines, and H. M. Wolfin, Superintendent of Safety, California Industrial Accident Commission, confirm my opinion that the Muldoon shaft is not and was not a second exit from the Argonaut mine in the full meaning of the law, but, rather, an upcast shaft used for no other purpose than ventilation. This is not saying it could not be used for climbing out of the mine in ordinary circumstances, but, as has been pointed out, the Muldoon shaft at the time of the fire would have proved a death trap, which only an unwise or badly frightened miner would attempt to use. Generally, miners are neither unwise nor do they easily become frightened. If before the fire the Muldoon shaft complied with the law, as stated by Mr. E. S. Boalich, chief mining engineer of the State Mining Bureau, why should it not have constituted a compliance with the law during the fire? The fire did not occur in the Muldoon shaft; if it had, the Argonaut incline would have been the method of escape. Since the fire was without the Muldoon shaft, then the Muldoon shaft should have been the method of escape. That it was not any kind of an escape, or exit shaft, at the time of the fire, both Mr. Boalich and Mr. Wolfin admit. Then it was not within the true meaning of the law a second exit.

Now, what is the answer to all this? Let us hear from Mr. Will J. French, Chairman of the Industrial Accident Commission. His communication sent out about Sept. 1 may throw some light upon the situation

of mine safety in California. Mr. French states that the California Legislature in 1862 passed a law requiring two exits, and that when the Mine Safety Orders were issued by the commission in 1916 the state law was made one of the safety orders, in addition to other orders covering this point: requiring the second means of egress to start 500 ft. from the bottom of the mine. He states that the Argonaut second exit started 150 ft. from the bottom and described it as "fully complying with legal requirement." So it does conform to the letter of the legal requirement, but does it conform to the spirit, intent, and purpose of the law?

At the time the improved mine safety laws were prepared Mr. French was secretary of the commission and Mr. Wolflin was chief engineer of the mining division of the commission, or chief inspector. I traveled with him while much valuable data for the drafting of new laws were obtained. I know he did his work thoroughly, and I believe conscientiously. But he did not meet with such welcome and encouragement as was due to his position and purpose, from the old-time mine superintendents and owners. I was then actively and regularly employed as a writer for the *Engineering and Mining Journal*, and often spent hours explaining to various mine owners and superintendents that Mr. Wolflin was not engaged in any effort to impose undue hardships, and that the purpose of the commission was to secure the necessary data for the preparation of state laws that would safeguard men and property. Their chief complaint was that he was not a graduate of one of the universities of California, and coming from the U. S. Bureau of Mines they considered him more a coal-mining engineer than a gold miner. Anyway, they did not want an outsider to come in to tell them how to run their mines.

Mr. French also says in this communication that, "The commission only has two safety mining engineers in the field, owing to limited financial resources. It is impossible to inspect mines as often as should be done." But Mr. French does not tell us that when the mine division of the Industrial Accident Commission was organized, there were one chief safety engineer and three deputy safety engineers, all engaged in the inspection of mines. The chief engineer, being appointed by the director of the U. S. Bureau of Mines and part of his salary paid by that Bureau, it was arranged that all four of the safety engineers should furnish data for that Bureau as well as the commission.

For the last two or three years (I am not sure of the exact dates) Mr. Wolflin has been employed as superintendent of safety in the commission and Mr. G. Chester Brown made chief mining engineer or inspector, engaged in field work along with Mr. F. L. Lowell and Mr. J. W. Gebb. Later Mr. Brown was called in from the field to entertain, inform, and advise mining men, visitors at the offices of the commission; an occupation that is not so important to the mines and miners of the state as inspection and safeguarding of men and property.

The ability to manage and control men, which Mr. French possesses to a marked degree, and learned in the printing business, is a qualification quite necessary in the handling of a political bureau or commission. It is also a valuable qualification for a mining engineer in almost every capacity. But it requires something more than this to make a man competent to control and guide a staff of educated mining engineers employed in the

safeguarding of the lives of miners and protection of mining property. As everyone engaged in or interested in the mining industry knows, the man who holds a position of this character should be especially educated and trained for it. The safety of the lives and the protection of the property involved in mining not only requires but demands it. Mr. French is a printer, not a mining engineer.

This mine inspection business belongs in the State Mining Bureau. But when it shall be placed there the man who has the appointing power will not do his whole duty to the miners, the mine owners and the mine property of the state unless he sees to it that the head of the State Mining Bureau shall be selected for his scientific knowledge and practical training in mining and the management of men.

LEWIS H. EDDY.

Oakland, Calif.

Reflections on the Argonaut Fire

THE EDITOR:

Sir—Reading of the Argonaut disaster, by T. A. Rickard, in your Sept. 30 issue leaves little doubt that a serious mistake was made in not immediately stopping the fan, and, as soon as possible, reversing it, thus changing the course of the ventilation in the mine. That thought occurs to the experienced engineer as soon as he studies Mr. Rickard's mine section, and it is emphasized when he reads the article. The idea that the entrapped men would not understand and would be confused is childish and gives little credit to the intelligence of the ordinary miner. The probabilities are that in the five hours' life allotted them in pursuance of this stand-pat policy, they were praying that some one would change the air current and dispel the awful fumes that were engulfing them. An entrapped miner thinks quickly and intelligently and has an intuition for "following the air."

The Cordova gold mine, at Cordova, Ont., had a similar experience in March, 1917, while I was manager, only we had five men caught, where the Argonaut had forty-seven. We forced an entrance to the burning shaft through an old stope, built a bulkhead under the fire, reversed the ventilator, and finally reached the miners, who were alive but weak. They had first taken refuge in an old stope, but when the air changed they knew it and went into the powder magazine on a lower level.

I know of several coal mines where similar rescues have been effected by reversing the ventilation. Each case has to be decided for itself as to where the miners probably are and whether reversing the ventilation will give them deadly gas or air.

In the Argonaut case it was known that the fire was above the miners, therefore reversing the current brought no hazards of carrying the fire to them. To an onlooker from a distance there appears to have been no chance for the men unless air could have been gotten to them. Miners can stand a lot if they have air; they have the trick of conserving their energies and prolonging their existence without food, if they have air.

The days of one-shaft, one-hoist mining have passed. Certainly, when a mine is 4,000 ft. deep it is entitled to proper equipment and safeguards for mine and men. Perhaps I am thinking forcibly, but one is apt to think forcibly after the experience of gasping for breath underground. Our sympathies are with the management, but our thoughts are to learn what we may from this sad calamity, to avoid a repetition of the disaster.

Franklin, Ky.

SAM HUGH BROCKUNIER.

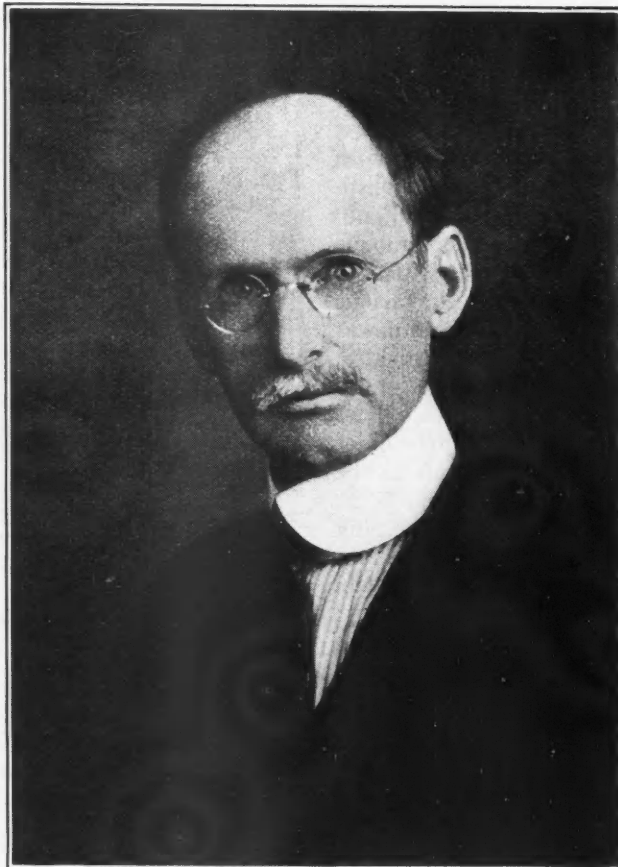
Metallurgists of Note

WILLIAM E. GREENAWALT

ALL METALLURGICAL ENGINEERS who read English have heard of William E. Greenawalt. But there are many who have read his numerous articles in the technical press, and who have pored over his "Hydrometallurgy of Copper," who have no further knowledge of the man—of his appearance, or personality. Under his name, on his letterhead, are the words "Engineer, Metallurgist," with no mention at all made of his ability as an architect. And yet, when he came to New York City after a six-year course at Cornell, he expected to make architecture his profession, and spent nine years at the work, even winning a \$1,000 prize in a competition. However, his eyes were not equal to the detail work required, and he decided to go West and take up the profession in which his brother, John E. Greenawalt, was engaged. For several years the two brothers had adjoining laboratories in Denver, and William closely followed the important work in up-draft and down-draft blast roasting originated by his brother, which culminated so successfully in the many prosperous plants of this type scattered about the world today, and which are licensed under the Greenawalt patents. But William Greenawalt was attracted more to the subject of hydrometallurgy, the future of which he believed to be most attractive. He was the first to apply electrolytic chlorine to the treatment of Cripple Creek ores. He was for some time foreman and afterward research metallurgist at the Portland Gold Mining Co.'s mill at Colorado Springs. This mill had four 100-ton roasting furnaces and twelve large chlorination barrels. One of these barrel units was used for the experimental work on electrolytic chlorine generated from salt in three 1,000-amp. cells designed by Mr. Greenawalt. During the early research work on the chlorination of gold and silver ores, the subject of leaching and electrolysis of copper ores and solutions attracted his attention, and he carried on a great deal of research work in this field. In 1910 he patented a chloride process for the extraction of copper. Since 1914 Mr. Greenawalt has been the metallurgist of the National Mines & Smelters Co., in

Mexico, and devised the metallurgical treatment for that company's ore. A small mill and sintering plant, and a smelter of 250 tons' daily capacity, were installed and operated, preparatory to a larger installation. Tests were also made on leaching low-grade matte for the

production of electrolytic copper and metallic gold. The work proceeded favorably until the revolutionists blew up the large power plant, flooded the mine, and put an end to all activities. As a result of his years of research and practical work, Mr. Greenawalt is a strong advocate of leaching and electrolysis in the treatment of copper ores, irrespective of whether the ore is of high or low grade, and whether oxide or sulphide. Since the publication of his book on the hydrometallurgy of copper, in 1912, he has devoted most of his time to the development of the electrolytic sulphate copper leaching process described in the last issue of the *Engineering and Mining Journal-Press*. The metallurgical success of this process seems well assured. Last year he spent six months with the Mountain Copper Co., in California, adapt-



WILLIAM E. GREENAWALT

ing the process to that company's ores and conditions, and fairly large-scale tests were made. How to obtain a patent is no secret to Mr. Greenawalt. He has taken out possibly fifty United States patents, mostly on hydrometallurgical processes and equipment. The Denver Engineering Works Co. has recently taken over the manufacturing rights for a flotation machine which he developed as a side issue, resulting from other research.

In 1892 Mr. Greenawalt was married to Cora M. Cornell, of Ithaca, N. Y. They have four children. In a wordy way, Mr. Greenawalt is not a rich man. He earned all of his expenses while at Cornell, and has invested most of his savings since that time in developing the electrolytic process bearing his name. Now, at the age of fifty-six, the hydrometallurgical treatment of ore, particularly of copper ores, is becoming more popular, and Mr. Greenawalt has good reason for thinking that there will be a wide field for the processes on which he has put nearly thirty years of study.

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Gold-Mining Developments in the Black Hills

A Brief Description of Some of the Activities of the Homestake and Trojan Mining Companies, the Only Properties Which Maintained Operations During the Recent Depression—The South Mill, at Lead, a Modern Reduction Plant

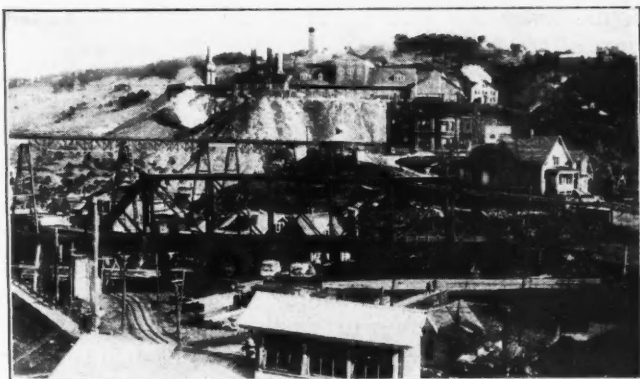
BY FELIX EDGAR WORMSER

Assistant Editor, *Engineering and Mining Journal-Press*

THE BLACK HILLS of South Dakota are neither black nor are they hills, according to the commonly accepted meaning of that term. Their particular tint is chiefly a whim of the weather, and they are amply large enough to be designated full-grown mountains. Geologically speaking, they comprise a domical uplift rising above the Great Plains. Viewed from the plateau level their height is unimpressive, and they seem to be a low, dark range, with a few summits towering here and there but slightly above their neighbors. Investigation has shown that the central peaks are pre-Cambrian schists, and that they slope gently out to a rim of paleozoic sediments which dip away from the hills. Intrusions of igneous rocks are common.

Set almost squarely in the center of the northern Black Hills are the important towns of Lead and Deadwood, both of which have been intimately associated with the mining history of the district. They are about four miles apart, although the actual distance depends upon whether the Burlington or the Chicago & Northwestern R R. is chosen to do one's transporting, as both communities are connected and excellently served by these railroads. The Northwestern takes a longer but scenically a more beautiful route, which gives the visitor superb views of the attractively wooded mountains. Lead has an elevation of about one mile above sea level; Deadwood is 1,000 ft. lower.

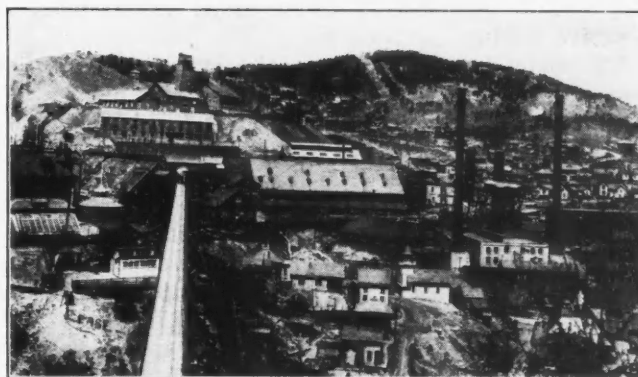
Prior to the war many small gold mines were active in the Black Hills. The Golden Reward, the Mogul, the Wasp, and numerous others made names for themselves. The deposits were generally in the shallow Cambrian



Ellison surface plant and trestle spanning Gold-Run Creek

formation which caps the Algonkian schists of the district. Many became profitable through working low-grade gold ore, and despite high freights, high labor, and high altitudes. In 1917 ten or twelve mines produced regularly. The decline in the purchasing power of gold affected them quickly, however, as it did every gold mine in the United States, and threatened their existence. Economies were instituted in the face of

advancing labor and other costs, and one or two mines hung on tenaciously as long as they could, but finally succumbed to the great disadvantages under which they were operating. A visit through the Black Hills will disclose many concentrators and mine plants in a sad state of decay, a grim reminder of the toll taken from South Dakota's gold-mining industry during the last six years. As it will take a relatively heavy investment



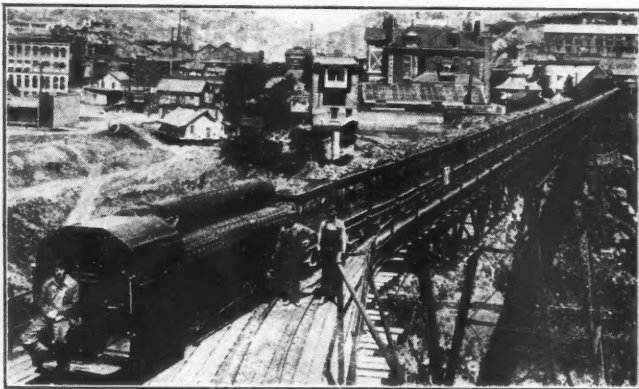
Old Abe, or B. & M. shaft, and a few of the older stamp mills

to reopen most of the properties, many have probably shut down for good. Others may resume again, although an exhaustion of ore deposits was imminent for a few.

GOLD MINES STRUGGLED TO KEEP OPEN

Throughout the entire depression two mines succeeded in operating where others failed—the Homestake Mining Co. and the Trojan Mining Co.—the former a gigantic, and aptly termed the greatest, gold mine in the world, and the other a much smaller venture. The worst is probably over, and these companies can now view with great satisfaction the sterling fight they have made against economic odds.

Peculiarly enough, the two mines, although only five miles apart in a straight line, are different in a great many respects. The Homestake is a deep low-grade gold mine, worked through vertical shafts piercing the Algonkian ore deposits of the company. It is a large-scale operation, and prior to the erection of its South mill normally treated about 4,500 tons daily. Homestake ore is of an average value of \$3.50 to \$4 per ton. The Trojan is a shallow mine in the Cambrian with a capacity of 400 tons per day. During the period of rising costs it was necessary for both these companies to reduce expenses by decreasing development and prospecting, and increasing, so far as possible, the life of supplies. The Homestake Mining Co. ordinarily has a program of 17,000 ft. of development work each year. During 1918 and 1919 this was reduced to 8,000 ft., but it is sufficiently advanced to obviate a heavy expenditure to bring it to normal proportions. The Trojan did the



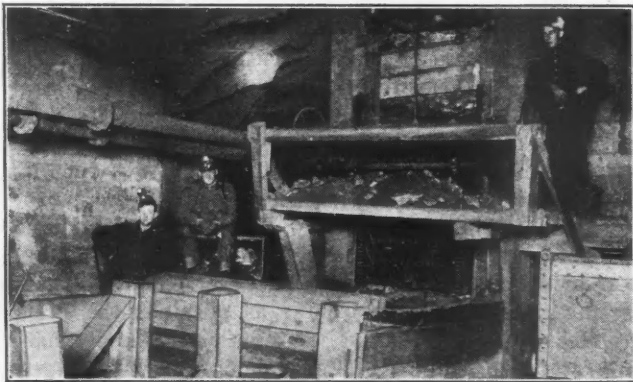
Compressed-air locomotive for special haulage on the surface

best it could to raise the grade of ore mined and endeavored to remove a minimum of \$5 ore by careful selective mining.

The struggles during the unpleasant last six years will add an interesting chapter to the rich history of the Black Hills. The population of Lead and Deadwood declined sharply. Whereas in 1900 these towns had a population of 12,045, in 1920 it was estimated at 7,416. Gold production of South Dakota also declined. Its peak was reached in 1912, when it amounted in value to \$7,891,000, and the low point in the depression was in 1920, when it totaled \$4,676,500, according to the U. S. Geological Survey statistics.

The Homestake is one of the oldest mines in the United States still operating. Its long life and enviable dividend record have combined to make it the greatest gold mine in the world. The total production from 1875 to the middle of 1922 is estimated to be \$176,300,000, from which dividends of \$42,693,500 have been paid. One of the striking things that impress the visitor to Lead is the number of employees that have worked for the company ten, fifteen, twenty or more years. I am informed that a Veteran's League exists in Lead whose membership is composed of men who have worked for the company at least twenty-one years, and the membership roster contains more than 150 names. When men stay in the employ of one company for long periods an admirable community of interest must exist between employer and employee.

There is evidence on all sides in Lead that life in that gold-mining camp has been made as pleasant as it is possible to make it. The homes of the miners and employees look well kept, with attractive gardens or hill-



Draw-chute leading to underground crusher at Homestake

side settings. Lead itself is a clean city; in fact, the entire community does not typify the ordinary conception of a mining camp. The company has provided an excellent library, billiard rooms, a splendid swimming pool, and other recreational facilities that are available without discrimination to inhabitant and stranger alike.¹ A moving-picture hall large enough to more than fill the requirements of any city of equal size supplies that popular entertainment to those who wish it. The Homestake Mining Co. may be proud of its welfare work, which is well worth study and emulation. At the present time a new hospital is being provided, which will furnish additional medical conveniences.

MANY RAMIFICATIONS TO ENTERPRISE

It is noticeable that the Homestake company has built a unit that is largely self-contained. It has its own timber tracts and yards, lime quarries, coal mines, hydro-electric power sources, and shops. In the foundries and machine shops everything is built that can possibly be manufactured locally. Thus, it is not surprising in visiting the plant to learn that here is a switch of distinctive Homestake design and manufacture and there a sharpener made in the Homestake shops. Although discouraging at times to the salesman of mining machinery, this ability to fashion quickly repairs and machinery that may suddenly be demanded from some quarter has not been without its advantages to the company, and many a "home-made" article has proved equal to the purchased kind on every comparable basis.

The Homestake works a deposit that is unique so far as gold mines in the Black Hills are concerned. It is commonly designated as a silicified slate, carrying free-milling gold in so fine a state as to be rarely visible, and profuse in the variety of minerals associated with the gold. Chief among these are pyrite and arsenopyrite, but they are not important gold-bearing minerals in the ore. A variety of hornblende, called cummingtonite, is a common mineral at depth, and its radiolarian or fibrous structure interferes with crushing, but aids in leaching. Ferrous minerals are found in the lower levels of the mine and affect the metallurgical treatment.

Irving believes that the Algonkian slates comprising the deposit are of sedimentary origin. The lode is of varying dimensions at its widest point, being perhaps 1,000 ft. wide, although the minable width averages far less than this. It is about three miles long, and pitches southeast. Eruptives of acidic type cut the slates, and the entire mass was compressed into sharp anticlines and synclinal folds. The ore has been found to be associated with the folding. Fracturing and faulting took place owing to further compression, and porphyry dikes were subsequently intruded.

The origin of the deposition is still somewhat obscure. It is only recently that the Homestake has systematically begun to learn the geological secrets of its great deposits through careful study of the mine. Two company geologists are busy upon this task, and a description of their method has already appeared in these pages.²

¹A paper by B. C. Yates, Superintendent of the Homestake Mining Co., entitled "Welfare Work at the Homestake Mine," describes the recreational facilities. It was published in *Engineering and Mining Journal* of July 31, 1920.

²"Geological Methods of the Homestake Mining Co.," by L. B. Wright and J. O. Hosted, *Engineering and Mining Journal*, Dec. 21, 1921.

The mine itself is a huge operation in which both glory-hole and underground shrinkage stopes are used. The glory hole, with its large fresh exposures, is a geologist's delight. It gives a cheaply mined source of ore. The men working in the glory hole, which is now a half-mile wide, have built small precariously located trails in it for themselves, and like true mountaineers use life-lines when necessary to drill and work in dangerous positions. The ore from the glory hole is drawn through mill holes in the mine and dropped on large underground grizzlies to be broken and trammed to the shaft.

Shrinkage stoping at Lead in the Homestake mine has been described in various papers.³ The walls stand remarkably well, and only a small amount of timber is required for support in the mine. The actual mining has undergone a gradual process of evolution. It is noticeable that the influence of several engineers on the staff who have had experience in low-grade Alaskan gold mining is being felt in underground operations. A recent modification of Homestake mining has been to carry some of the stope floors about 10 ft. higher than the haulage level, and to use chutes, thereby eliminating the use of shoveling sollars in transferring the ore from stopes to cars.

A development of great interest at the Homestake is the remodeling of the Ellison shaft and the construction of the South mill to replace several of the older units, which will be razed. The Homestake mine is worked through two shafts 1,730 ft. apart, the "Old Abe," or B. & M. shaft, and the Ellison. The "Old Abe" is situated in a part of the property that is subject to subsidence from the glory-hole operations and it not so handy to the new South mill as the Ellison shaft. Furthermore, as the Ellison is in a section of the deposit closer to the place of future mining, it is natural that efforts should be made to enlarge its capacity. It formerly was without loading pockets and means for rapidly hoisting large tonnages of ore. Shaft dimensions had to be altered, skips substituted for cages, a new electric hoist installed, and numerous other changes made that practically completely remodeled shaft and equipment. Additional air compressors are being added.

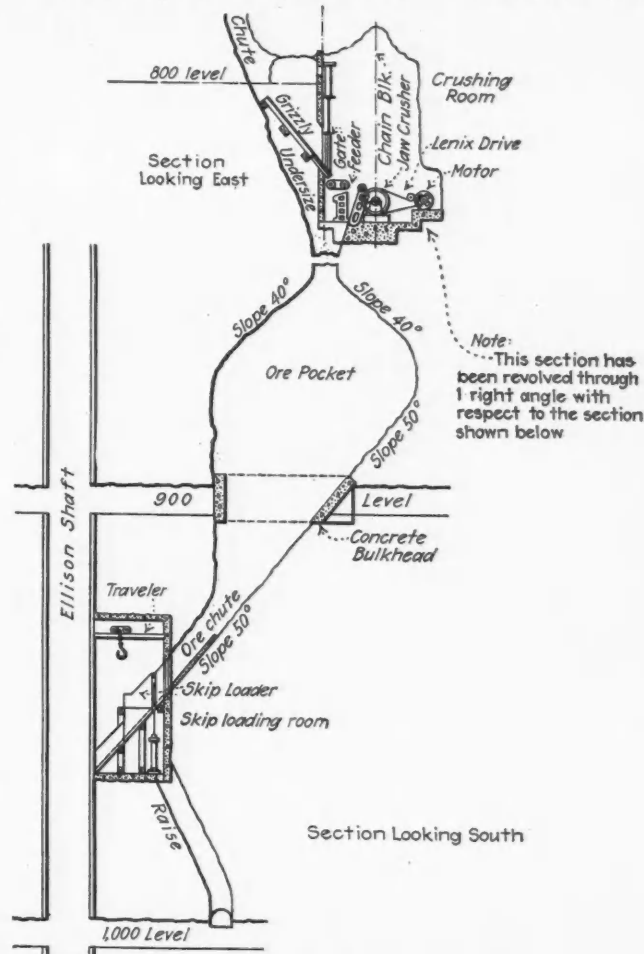
AMPLE UNDERGROUND STORAGE FACILITIES

Three underground crusher stations and loading pockets were constructed just below the 800, 1,400, and 2,000 levels. A diagram which has been taken from a sketch by K. D. Pyle shows the arrangement of crushers, pockets, and skip-loading device. The Traylor jaw crusher used is shown in an accompanying photograph, has an opening of 48 x 36 in., and is set to crush to 4½ in. It is cast in halves and held together by two heavy steel bands. Special thought had to be given to the size of the various parts of the crusher so that they could be sectionalized and lowered through the Ellison shaft. The crusher is driven by a 125-hp., 2,200-volt., 720-r.p.m. motor with a short belt (Lenix) drive, and has a capacity estimated at 200 tons per hour.

In the figure the ore coming from levels above 800 is trammed to chutes and falls upon a grizzly made of 6-in. steel shafting set 6 in. apart. The oversize passes into an apron feeder 5 ft. x 5 ft. 3 in., and undersize drops into the main ore pocket which has a capacity of 1,500

tons. From the ore pocket the ore passes to measuring pockets which fill the seven-ton skips in use. A photograph of the measuring pocket is reproduced elsewhere.

The Ellison shaft, prior to its remodeling, was equipped for cages and the use of flat ropes. The new arrangement retains one cage with a counter-weight, both using 7½ x ½-in. flat rope as before and handled by the old hoist. In addition two skips using 1½-in. round rope are operated by the new electric hoist. To make a place for these skips it was necessary to make a simple alteration in the layout of the shaft. The Ellison originally had three compartments, two of them 5 x 10 ft. with cages, and the third, 6 x 10 ft., containing pipe and



Sketch of underground crushing and loading arrangements at Homestake mine

manway. By moving the divider between cage compartment and manway 6 in. toward the center of the shaft, three compartments were made, respectively 5, 5½, and 5½ ft. in width. The unaltered 5-ft. compartment holds a cage as before, while the two 5½-ft. compartments contain the skips. As a smaller horizontal area is required for the skips than for the cages, excess space is provided in the skip compartments, which is utilized partly by a cage counterweight in the skip compartment adjacent to the cage, and partly by a pipe compartment.

The steel headframe formerly used at the Ellison shaft has been replaced by a newer, stronger and larger one with four sheaves, two of whose centers are 95 ft. 6 in. above the collar of the shaft and two (counter-weight and cage) 65 ft. above. An idea of the size of the main sheaves may be gained from an accompanying illustration. The rims are made of manganese steel,

³"Mining at the Homestake Mine," by B. C. Yates, Black Hill's Mining Men's Association, 1904; abstracted in Mining Engineer's "Handbook"; Peele.
 "Stoping at the Homestake Mine," by J. Tyssowski, *Engineering and Mining Journal*, July 9, 1920.

mining in its immediate vicinity. Although the Homestake mill is still operating, it is only because each battery of ten stamps has its individual motor drive. The entire building has settled noticeably.

Homestake metallurgical practice has been thoroughly described in several exhaustive and excellent papers¹ and has been prominently associated with world progress in stamp milling, amalgamating, and cyanidation of gold ores. The milling plant is not confined in one compact unit, but is distributed in several buildings, which are sometimes located thousands of feet apart. The Amicus, Golden Star, Homestake, Pocahontas, Mineral Point, and Monroe are individual older stamp mills which have in the aggregate 1,000 stamps. Clarifying houses and sand plants also are built separately near the stamp mills. Inside amalgamation is practiced, quicksilver being added to the mortar, the crushed ore is passed over plates, classified by means of cones into sands and slimes, and the sands are leached and the slimes treated in a large filter plant in Deadwood. The South mill will partly replace the older units, and will not tax the capacity of the present sand and slime plants, which are large enough to handle its product.

The capacity of the slime plant has been increased by the use of "booster pumps" and auxiliary tanks. The filter presses in the plant are run at 33 lb. pressure, compared with 16 lb. formerly used, as it has been found that tons of solution rather than time of contact is the more important factor. The only additional cost involved in passing the slimes from the South mill through the plant is that of chemicals. It would not be surprising to find that the operation of the South mill will set a new record for low-cost gold milling.

The flow sheet of the South mill was designed by Allan J. Clark, chief metallurgist, who has been identified with Homestake metallurgy for more than twenty-five years. It represents the careful study of metallurgical practice as applied to gold ores for a long period, and the selection of machinery and a flow of pulp that would give the most economical recovery of gold from Homestake ore. Older local practice is chiefly followed in that a large area of amalgamating plates, and classifying cones, and the use of stamps for coarse crushing, have been retained. Stamps have been built heavier; whereas the stamp duty of the smaller size was 4.2 tons per day, the new ones will more than triple this.

Four-ton cars hauled by compressed-air locomotives dump the ore into a steel bin of inverted V-shape design, having a capacity of 7,200 tons, from which the ore is fed by means of suspended Hendy Challenge feeders to 120 stamps. The water feed for the stamps is supplied by an iron water pipe placed parallel with and back of the mortar, to which five short pieces of smaller pipe have been welded. These are connected with cocks and short lengths of discarded rubber air hose leading to the mortar. This construction lessens vibration of the pipe. One-third of the mill has been equipped with short trommels placed between feeders and stamps, and if their performance warrants they will be used throughout. The stamps are arranged in two rows of sixty each, back to back, with ten of them in two mortars placed on each block. They are driven, how-

ever, in units of five by 25-hp. motors—a departure from the ordinary Homestake practice of having an individual drive for every ten stamps. The weight of the stamps has been increased from 900 lb. to 1,550 lb., and their rate of drop increased from 88 to 100 per minute, whereas the length of drop has been decreased from 10 to 8 in. The cam shaft is 6 in. in diameter, and the cams have a 32 $\frac{3}{4}$ -in. horn. A blanton key, 4-in. stem, three-key tappet, and two mortars on one block are used. The concrete blocks' batter is 1 $\frac{1}{2}$ in. per foot.

The screens used with the stamps have $\frac{1}{2}$ -in. mesh, and the pulp passing through them joins the undersize from the trommels and flows to six dewatering cones with 65-deg. slopes to their sides. The spigot discharge of these cones is reground in six 5-ft. x 10-ft. $\frac{1}{2}$ -in. Allis Chalmers rod mills, operating at 22 r.p.m., with 100-hp. motors and a rod charge of 29,000 lb. Each mill has a rated capacity of 200 tons per day and works in closed circuit with a Dorr duplex classifier, 4 ft. 6 in. x 21 ft.



Settling cones in classification section

4 in., having a slope of 2 $\frac{1}{4}$ in. per foot and making twenty-six strokes per minute. The classifier overflow, an 80-mesh product, unites with that from the dewatering cones and passes over twenty-four 9 x 12-ft. amalgamating copper plates, which are silver plated with 2 oz. of silver to each square foot of plate. This gives an area of 21.6 sq.ft. of plate per stamp.

The tables are so arranged that each pulp stream flows over two plates. Four 7-ft. dewatering cones receive the pulp in the next stage in its treatment, the underflow of these being reground in one 5 x 14-ft. Allis Chalmers tube mill after passing through one Dorr classifier. The product of this mill is passed to an amalgamating plate and then to eight 7-ft. cones. The underflow of these cones is transferred to Cyanide Plant No. 1 for further separation into sand and slime. The overflow of the four tube-mill cones is passed to eight 10-ft. cones, whose spigot discharge passes to the eight 7-ft. cones. The overflow of the eight 10-ft. and eight 7-ft. cones passes to three 32-ft. Dorr double-tray thickeners, the overflow going back to the mill as wash water and the underflow to the slime plant in Deadwood for further treatment.

At this point I wish to make grateful acknowledgment of the many courtesies shown to me by the members of the Homestake company's staff in affording opportunities for me to familiarize myself with the company's activities.

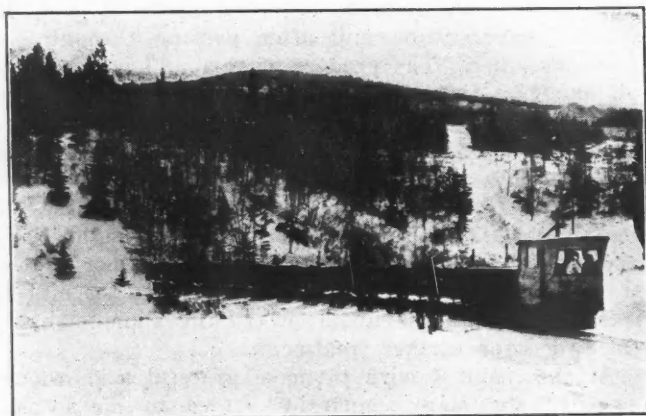
¹"The Metallurgy of the Homestake Ore," by Allan J. Clark and W. J. Sharwood; *Transactions of the Institution of Mining and Metallurgy*, Vol. 22 (1912-1913). An exceptionally valuable contribution to metallurgical literature.

²"Notes on Homestake Metallurgy," By Allan J. Clark; *Transactions of the American Institute of Mining Engineers* (1915), Vol. 52, p. 3.



The Trojan mill with outlying buildings

The Trojan Mining Co.'s chief workings are situated close to the right of way of the Spearfish branch of the Burlington railroad, at an elevation of about 6,000 ft., or 1,000 ft. higher than the elevation of Lead, S. D., and on the north side of Green Mountain. The mine is in the Cambrian formation, and its geology is similar to that of many of the mines of equal size in the Black Hills. A series of Cambrian strata lies unconformably upon the upturned metamorphic schists of the Algonkian. These strata have been fractured and fissured in zones of fairly uniform trend, with a strike of 20 deg. NE.-SW. The local name for the fractures and fissures is "verticals," owing to their vertical position. They have been mineralized, and the shoots or valuable portion of the verticals vary in height from a few inches to 25 ft., with an average of perhaps 6½ ft. The verticals pass through shales, dolomite, conglomerates, and igneous rocks, all of which affect the richness of the deposit. The limestone seems to be particularly favorable to the deposition, and where the vertical passes through a limestone stratum, mineralization generally extends further to either side of the vertical than when it passes through some other rock. The miners term



Ore train hauled by gasoline locomotive. Note slope leading to mine

the limestone "sand-rock" because of its usual sandy and oxidized nature, and consider it a valuable ore indication.

The verticals may be extremely narrow in width—a fraction of an inch—or they may widen out to several inches. They often occur bunched together, and where they intersect, the ore is generally richest. The roof is most often a shale which has proved impervious to further deposition in the vertical, and the floor a conglomerate or quartzite.

The ore is discolored, and seldom shows free gold. It contains pyrite, which is gold-bearing, and which gives trouble in cyaniding. The ore also contains gold in an extremely fine state of division, and is often bluish gray in color—characteristic of the local limestone—and it, also, gives trouble in cyaniding. Although it has been thought that the presence of tellurium is responsible for the difficulty in cyaniding, the explanation has also been made that the hard blue rock contains troublesome sulphides.

The general procedure in mining is to follow the verticals persistently. To do this it is necessary to run a series of parallel drifts or rooms with pillars of barren country rock between. A glance at a map of the Trojan mine shows a large number of scattered but parallel rooms that greatly resemble the appearance of a coal mine. During the war a higher grade of ore was sought than would normally have been required. Five-dollar ore was the standard chosen and maintained, although the plant was designed to treat three-dollar ore. As a consequence, sampling was carefully and frequently done. The size of the rooms was reduced, and only ore close to the verticals and satisfying grade requirements was removed. The ground stands well. Round stulls are used when necessary, and the ore breaks easily.

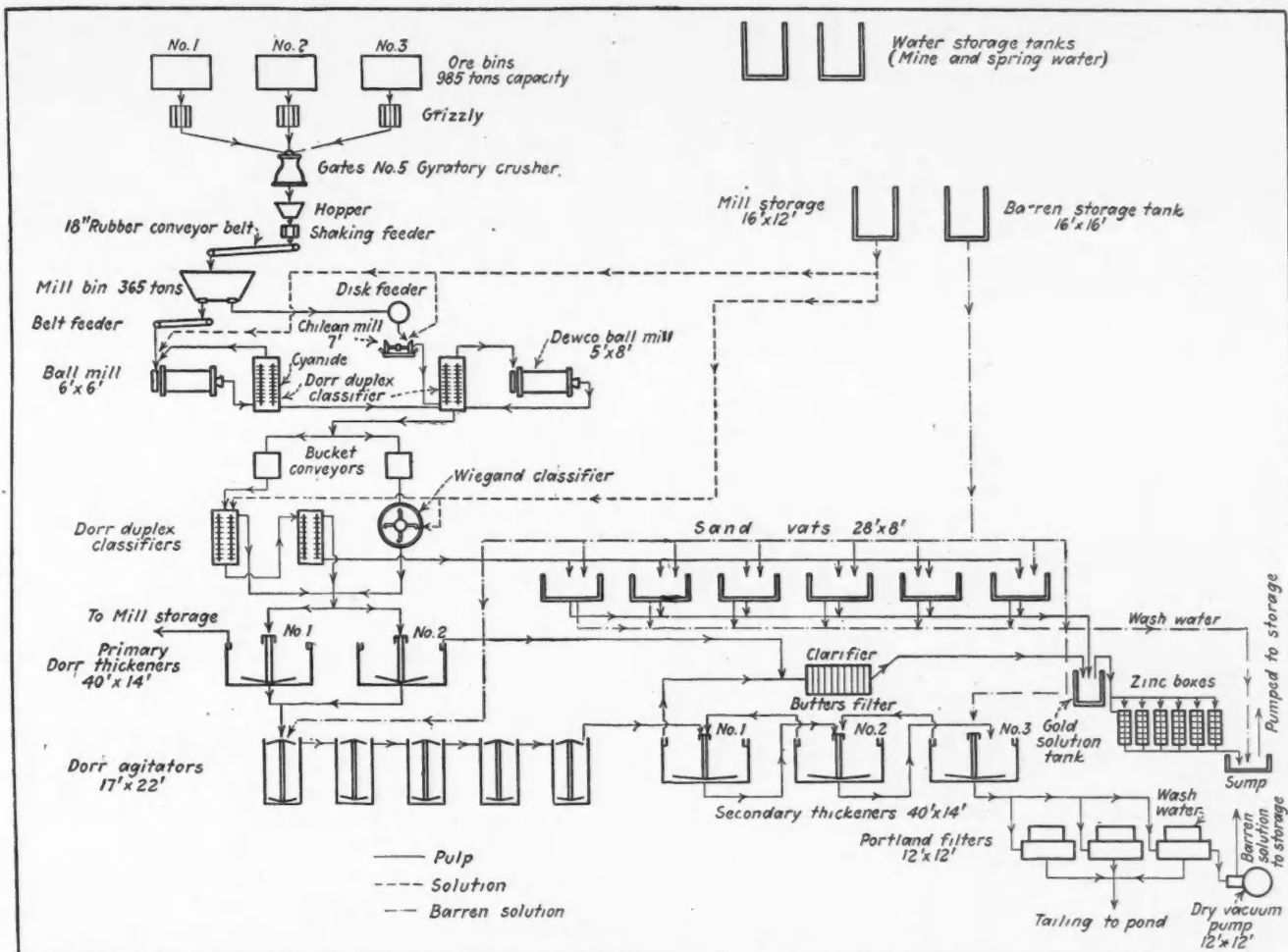
The mine is generally flat, and mining is now confined to one level. However, in following the verticals it is frequently necessary to vary the grade. This gives a certain irregularity to the level of the rooms. Horse haulage is used to haul the ore car or cars to a gather-

ing station, where a string of four cars is hoisted by a small electric hoist up a 12 per cent grade. At the top of this grade the cars are dumped into a storage pocket and chutes leading to the main haulage level and slope 150 ft. below.

The main haulage slope is 1,500 ft. long on a 6 per cent grade. Eight 1½-ton capacity cars are hauled up this slope to the surface by a single-drum electric hoist. There the rope is detached from the forward end of the ore train and fastened to its rear so that the cars may now be lowered on the surface down a 15 per cent grade about 2,000 ft. to a surface gathering station. Gasoline locomotives train the ore cars from the surface gather-

shaking feeder supplying an 18-in. rubber-belt conveyor 110 ft. long leading to a mill bin with a storage capacity of 365 tons.

Secondary crushing is done by a Monadnock 7-ft. Chilean mill and a more recent installation of a 6 x 6-ft. Allis-Chalmers ball mill, with herringbone gears. The management echoes a sentiment I find expressed elsewhere that the added cost of herringbone gears is well worth while in increased smoothness of operation although dirt must be carefully excluded. Five-inch balls are used in this mill. Both grinding machines are served by Dorr duplex classifiers, the ball-mill classifier operating in closed and the Chilean in open circuit.

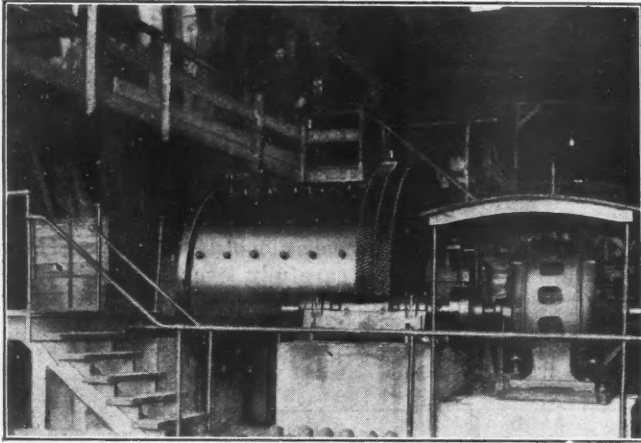


Flow sheet of Trojan mill

ing station to the mill, another 2,000 ft. An accompanying photo shows the Milwaukee locomotive used and the surface slope down which the mine cars are lowered to the gathering station. Gasoline locomotives have proved entirely satisfactory at the Trojan mine. It costs about 6c. per ton to tram the ore with these locomotives.

The Trojan mill is a cyanide plant with a capacity of 400 tons using leaching of sands and agitation and counter-current decantation of slimes. The ore delivered by the gasoline locomotives falls into one of three ore bins having a total capacity of 985 tons. The ore from the bins is passed over grizzlies set to 1½ in., the undersize dropping into a hopper and the oversize passing through a No. 5 Gates gyratory crusher set to 1½ in. The gyratory product falls into a hopper over a

A Dewco 5 x 8-ft. ball mill, using 2½-in. balls, receives the oversize sand from both the Chilean and Allis-Chalmers mills and operates in closed circuit with the Chilean mill classifier. The Allis-Chalmers mill grinds to a product running 3 to 4 per cent plus 10 mesh; the Dewco mill to 8 per cent on 60 mesh. Bucket elevators lift the pulp from the Chilean mill classifier to one Wiegand and two Dorr duplex classifiers, where the separation of sand and slime is made. Ordinarily this runs 59 per cent slime and 41 per cent sand. The sand is distributed in six sand vats, 28 x 8 ft., where it receives a leaching treatment lasting from seven to eight days. The slime, containing 46 to 50 per cent moisture, passes to two 40 x 14-ft. Dorr thickeners part of whose overflow is returned to mill storage and part passes through the zinc boxes after clarification. The



Interior of Trojan mill showing ball-mill installation

underflow from the thickeners is passed to five 17 x 22-ft. Dorr agitators operating in series, where the pulp is diluted to 2½ solution to 1 of solids. The pulp is then transferred successively to three Dorr thickeners operating on the counter-current principle. The overflow from the first thickener is clarified in a Butters filter and passed through zinc boxes, which are dressed twice a month to remove the precipitated gold.

Three Portland filters dewater the tailing from the secondary thickener, No. 3, which then passes to a large tailing pond. Extraction varies from 75 to 85 per cent on a five-dollar ore. This result might possibly be improved by the introduction of additional machinery and a modification of the flow sheet, but economic conditions in the last five years have not permitted gold mines to

indulge in much experimentation and purchases of new equipment. In 1919, however, the Allis-Chalmers ball mill was installed to enlarge the capacity of the mill. The Trojan has made the best of a difficult situation, and that it has succeeded in maintaining operations where other mines have shut down is ample evidence that its course has been properly laid out. The Bureau of Mines has experimented with the blue rock of the Black Hills, as it is a common constituent of many other ores in the district, but no recommendations have been made.

Perhaps the single feature which distinguishes the Trojan flow sheet from others is the use of the Wiegand classifier, invented by William Wiegand, chemist of the company. A sketch of this machine is given in an accompanying diagram. It consists essentially of a bowl with a shallow sloping interior in which four arms with rakes travel at the rate of 1½ r.p.m. Pulp is fed to the classifier by means of an annular ring with perforated holes, and is distributed evenly into the bowl. The slimes overflow into a column with a large mouth placed in the center of the bowl. By altering the height of this column, the quality of the slimes discharged can be regulated. The sand is raked with arms up the sides, and is discharged over the edge of the bowl to fall into an annular launder. It is claimed for the machine that it gives a better separation of sand and slime than other rake classifiers. It has proved entirely satisfactory at the Trojan mill.

Both the Homestake and Trojan companies now use the dark flaky Aëro brand low-grade cyanide. Considerable difficulty was experienced at first in properly adding this chemical to solutions. It generates acetylene and other gases on being added to water, but the experiments of the Homestake company have not disclosed anything harmful in them. Aëro cyanide has been found highly satisfactory in cyaniding Black Hills ore. The low-grade chemical has been found to be just as efficient as the purer white material, but care must be taken in its addition to the circuit. It may be that the trouble which users of this product have had in Ontario is due to the method of adding the chemical. Preliminary dissolving in barrels or vats is necessary. The flaky cyanide may be fed by hand, or, as in Homestake practice, by a small screw feeder into a suitable sprayed receptacle and screen to catch any undissolved residue. An ingenious arrangement devised by Mr. Whitney, of the slime plant, uses a 10-in. paddle wheel placed in a launder and actuated by the flow of solution as it passes from one tank to another to drive the screw feed. The cyanide drops into the center of an annular spray of water. Rapidity of feeding can be regulated by step pulley. The absence of any strong odor with this arrangement is striking.

Cyanide consumption in the Trojan mill is 0.4 lb. per ton. A protective alkali content of 1.8 lb. is used. The bullion produced varies from 700 to 500 parts silver and 280 to 500 parts gold.

I wish to thank Mr. C. E. Dawson, manager, Mr. William Wiegand, chemist, and Mr. Goodrich, mill superintendent of the Trojan Mining Co., for the many kindnesses extended to me on the occasion of my visit to their plant. My thanks are also especially due to Mr. A. A. Lease, of the Homestake engineering staff, for supplying the photographs in this article illustrating Homestake operations and for those in the plates of the half-tone section which follows.

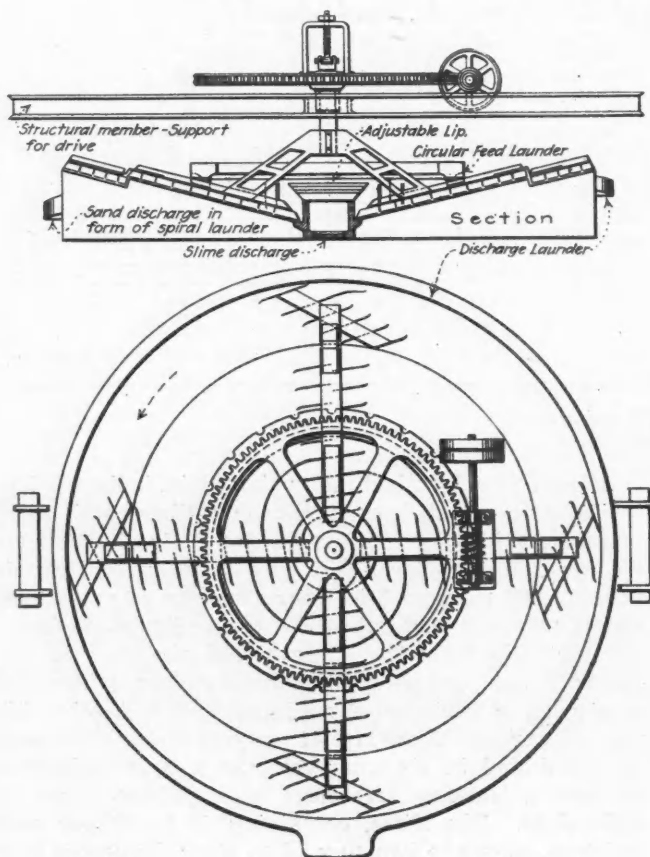
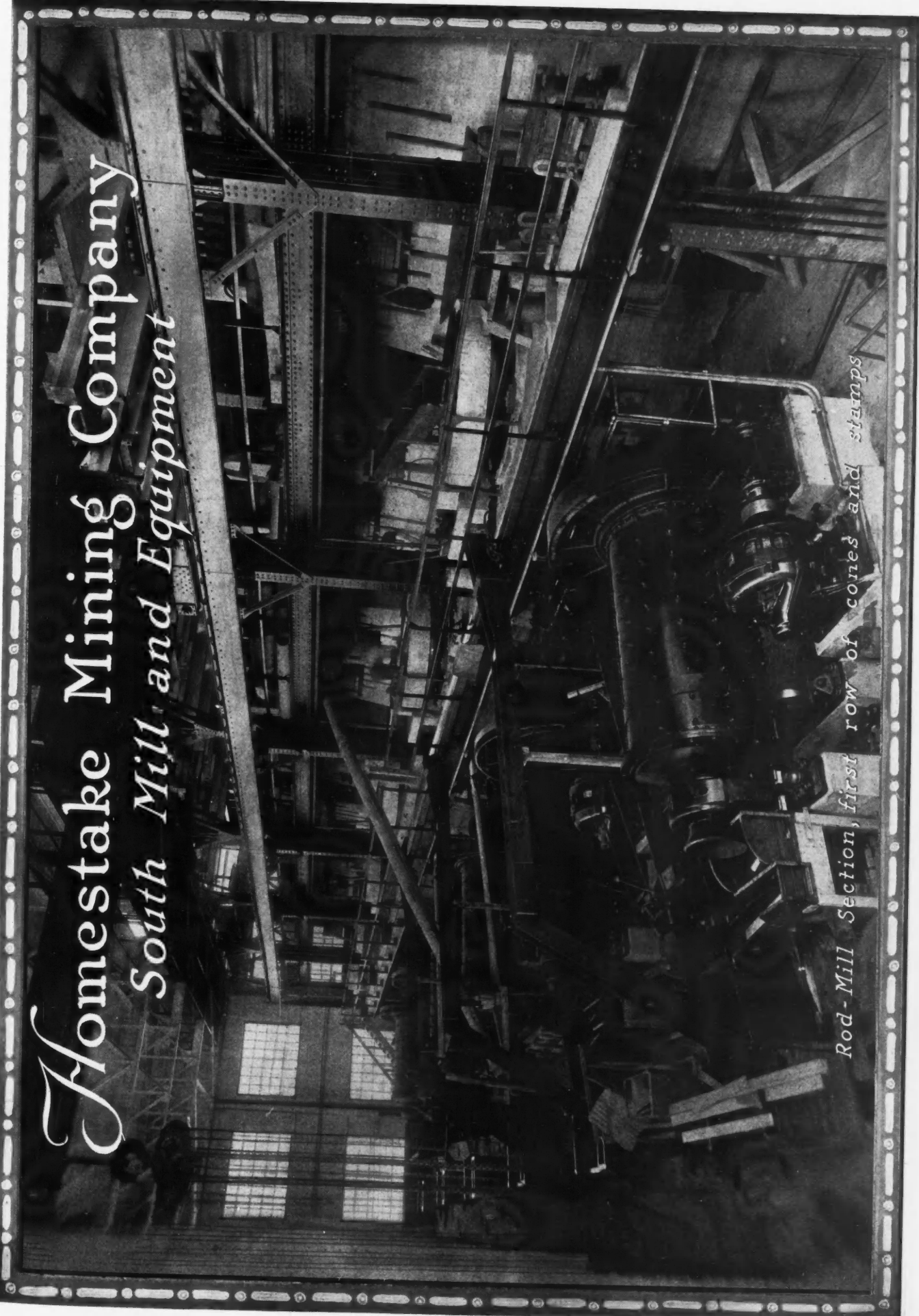
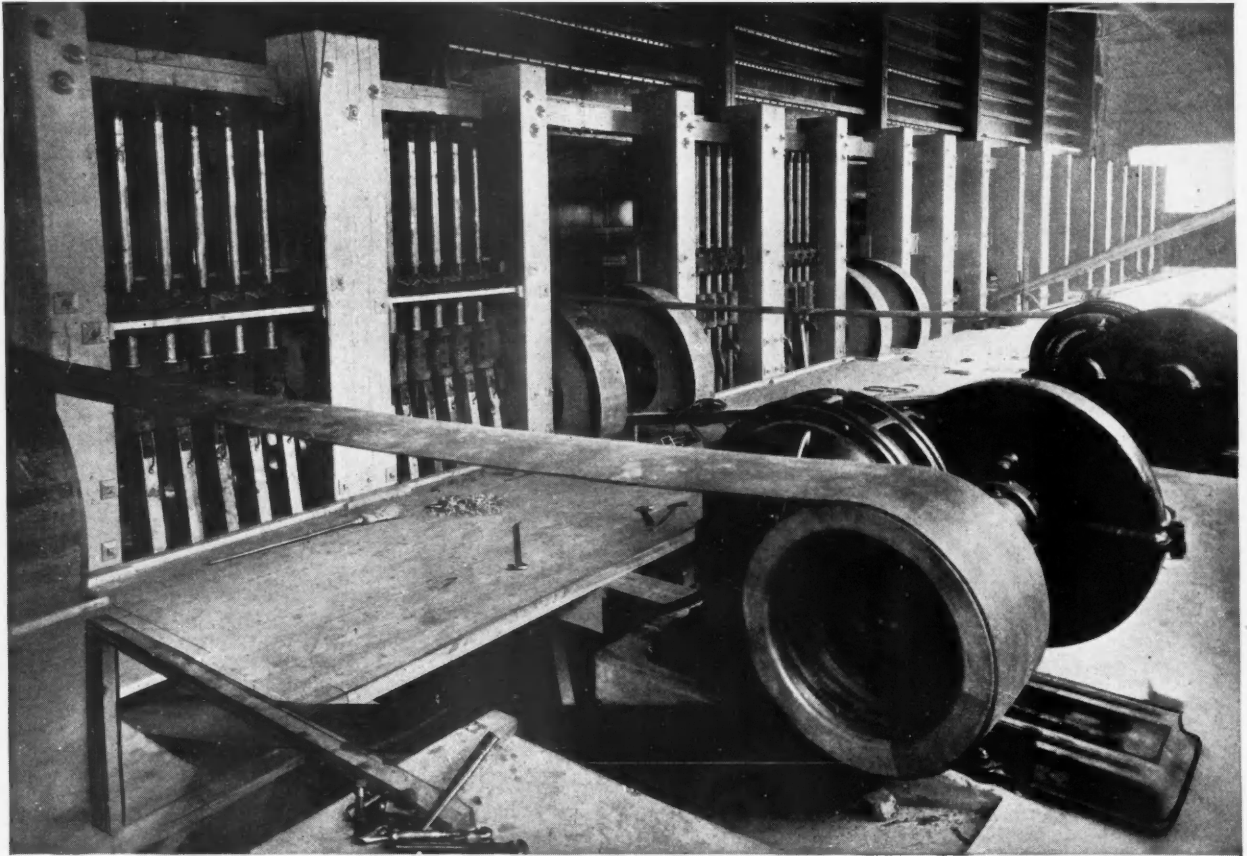


Diagram of Wiegand classifier

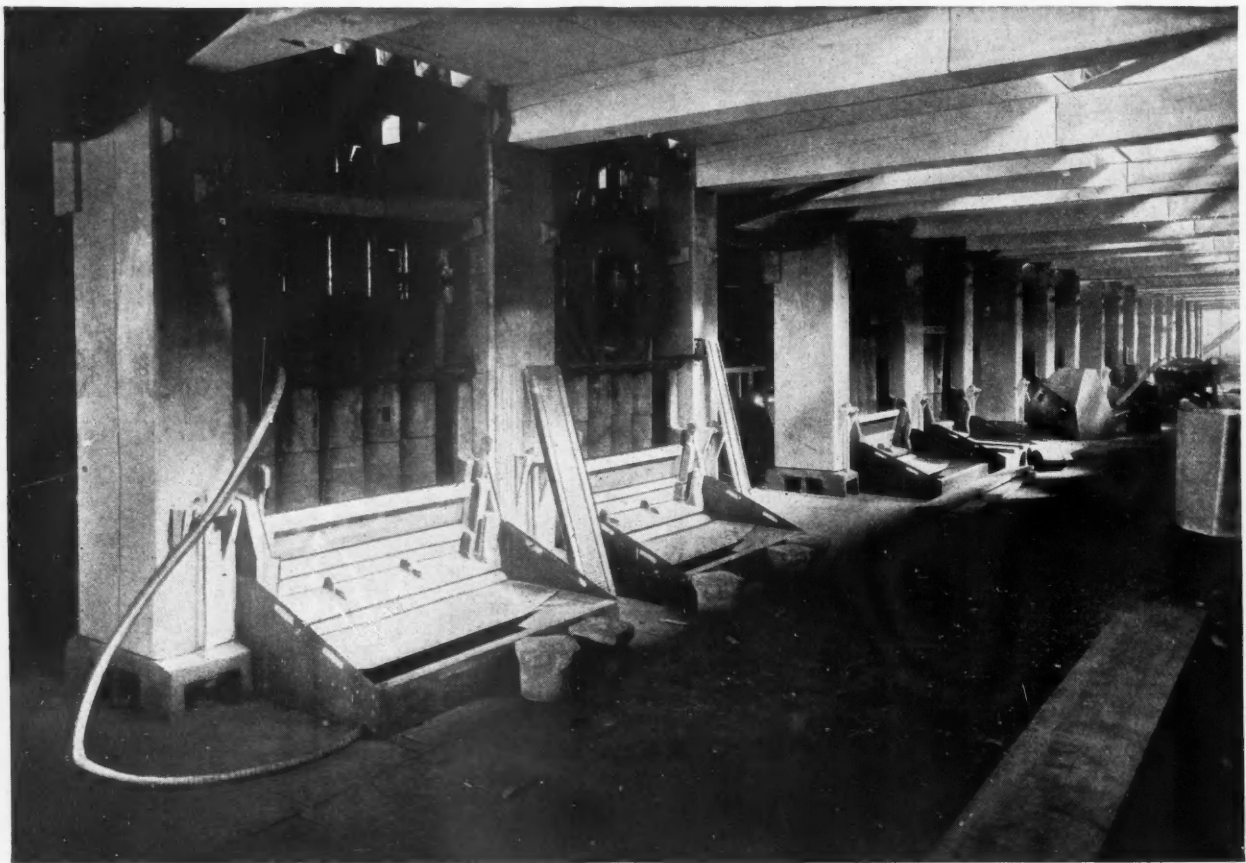
Homestake Mining Company South Mill and Equipment

Rod-Mill Section, first row of cones and stamps

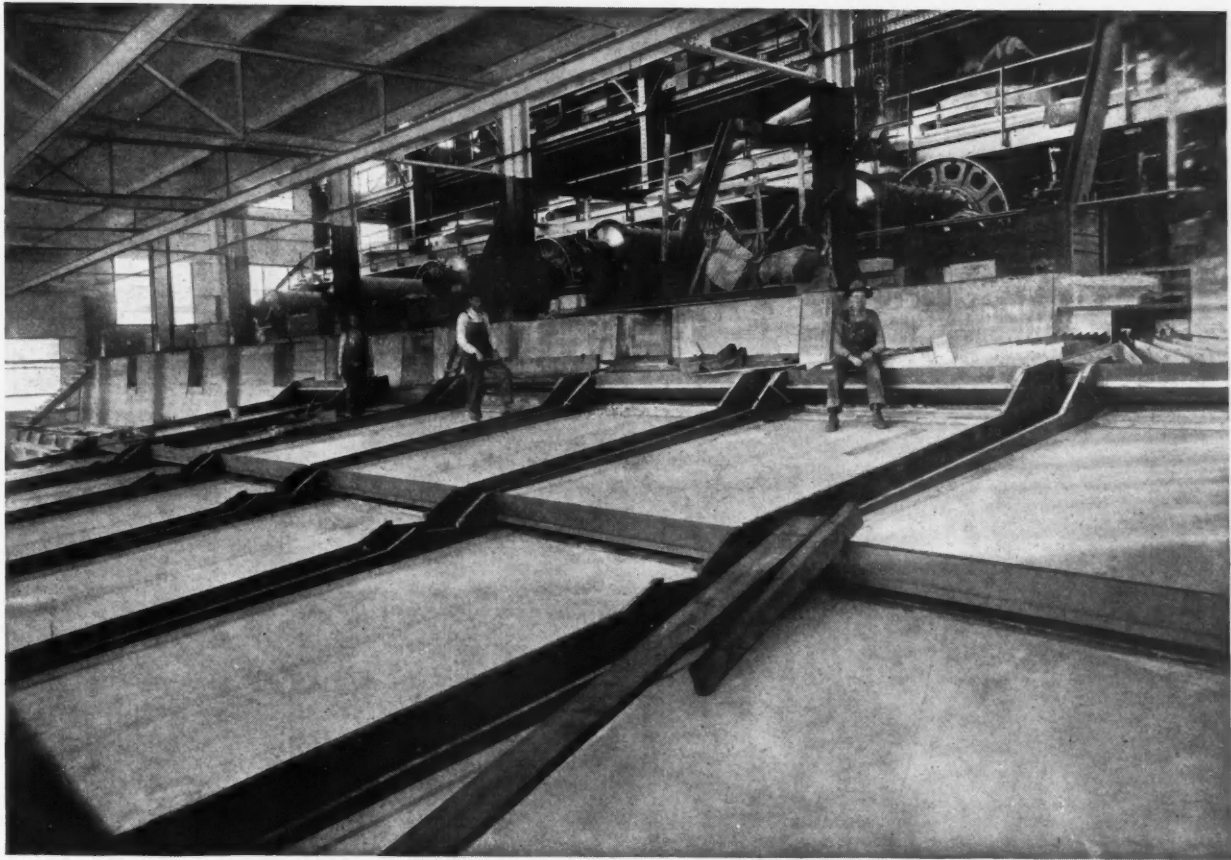




Cam floor of stamp battery. Individual drive for each five stamps



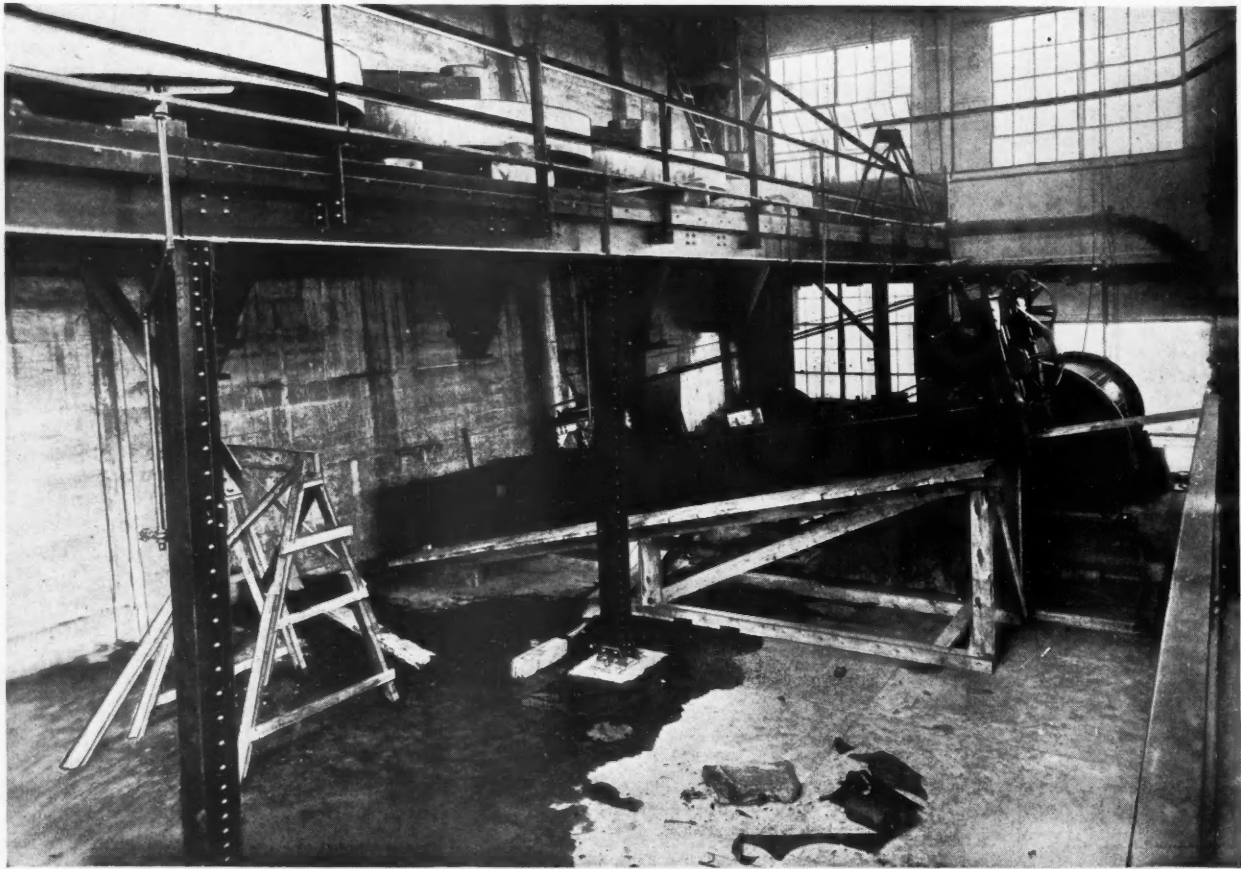
Battery floor and mortars at south side of ore bins



Amalgamating plates and rod-mill units of the South mill



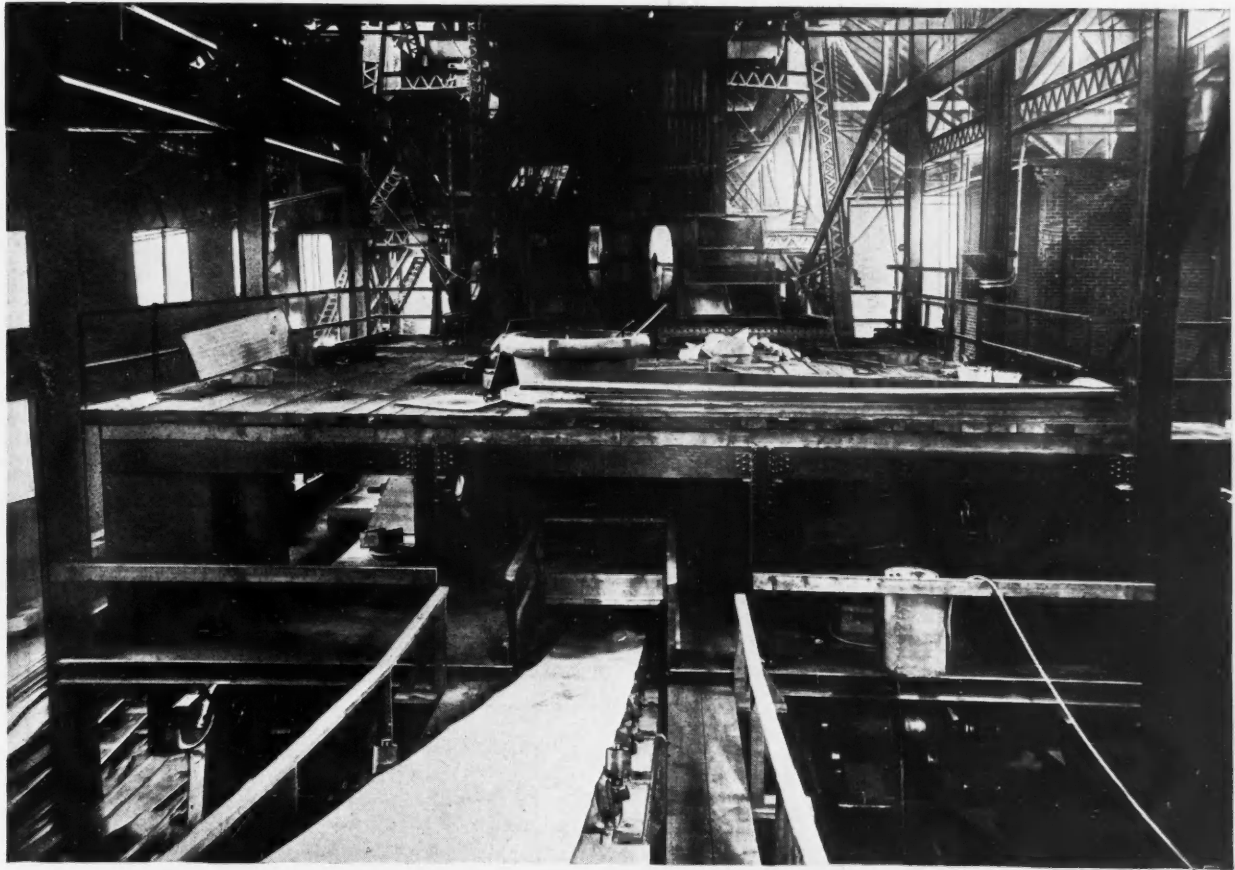
Classifying cones and regrinding section



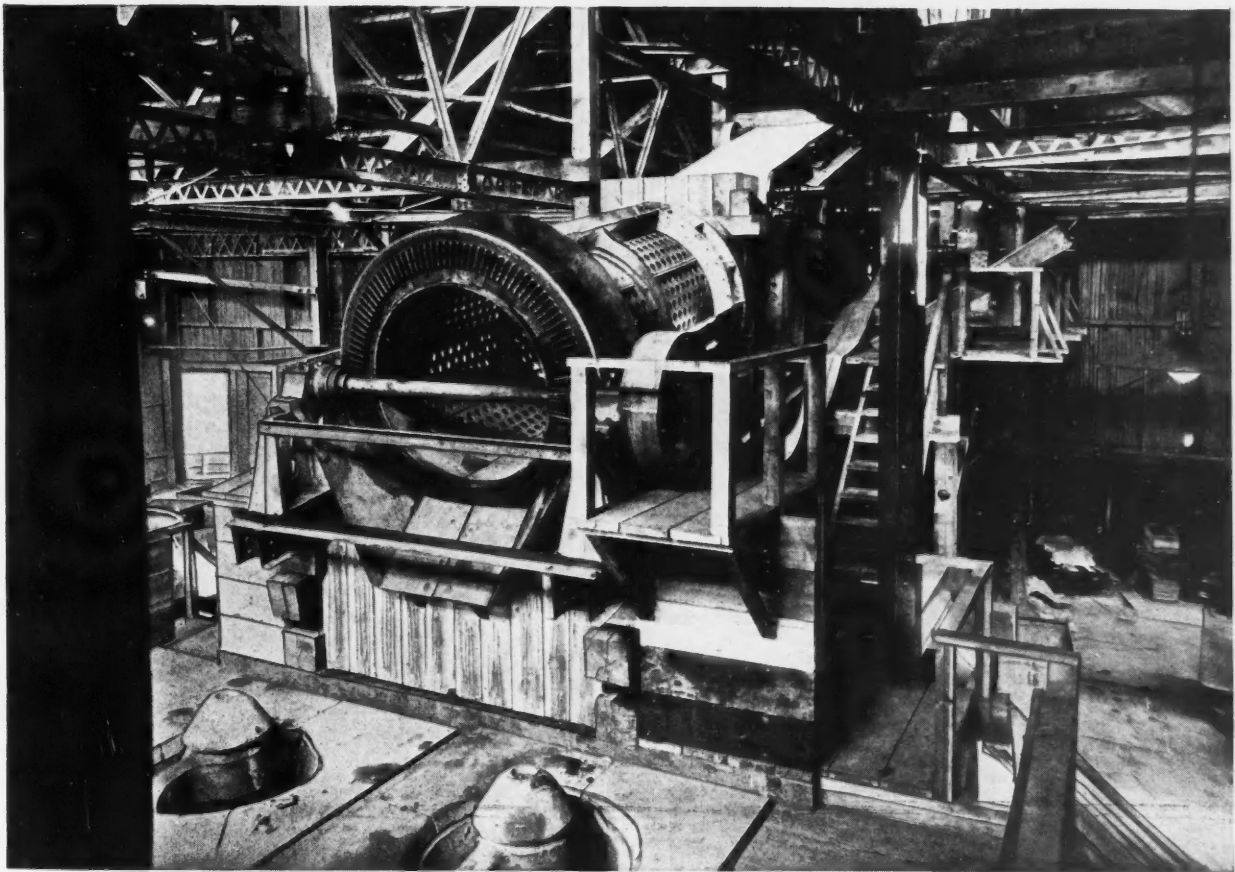
Tube mill, Dorr classifier and cones being erected



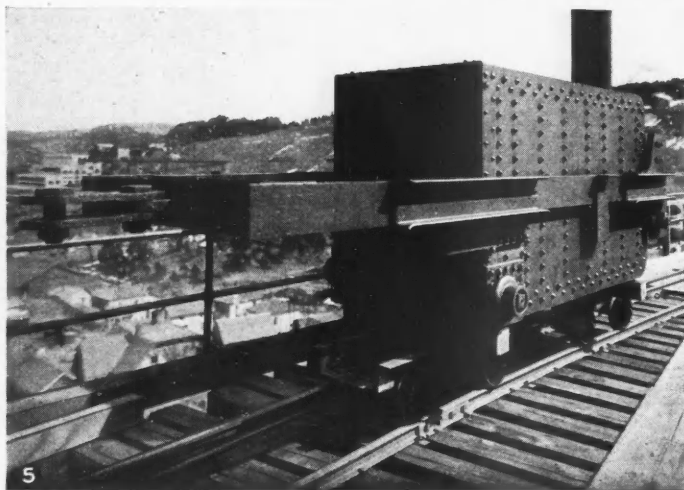
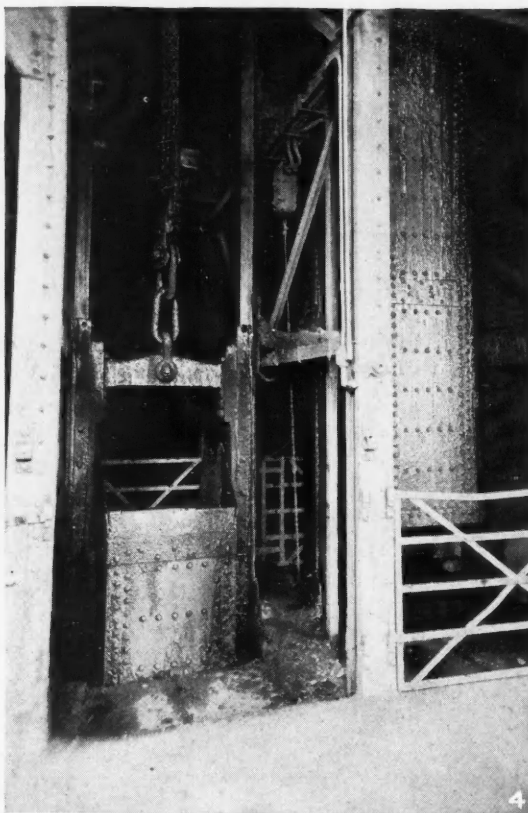
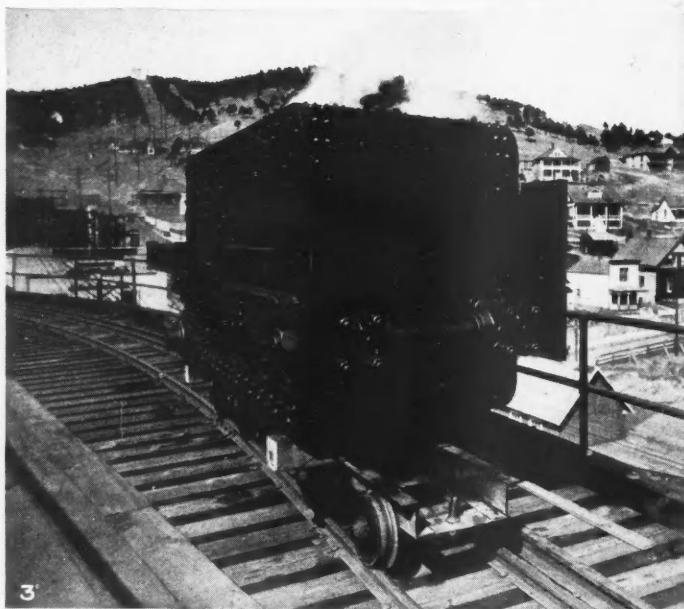
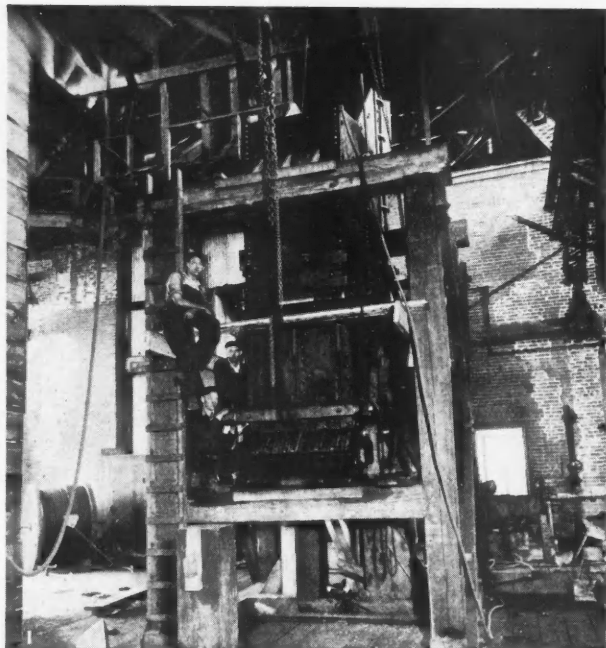
Settling cones in classifying section of mill



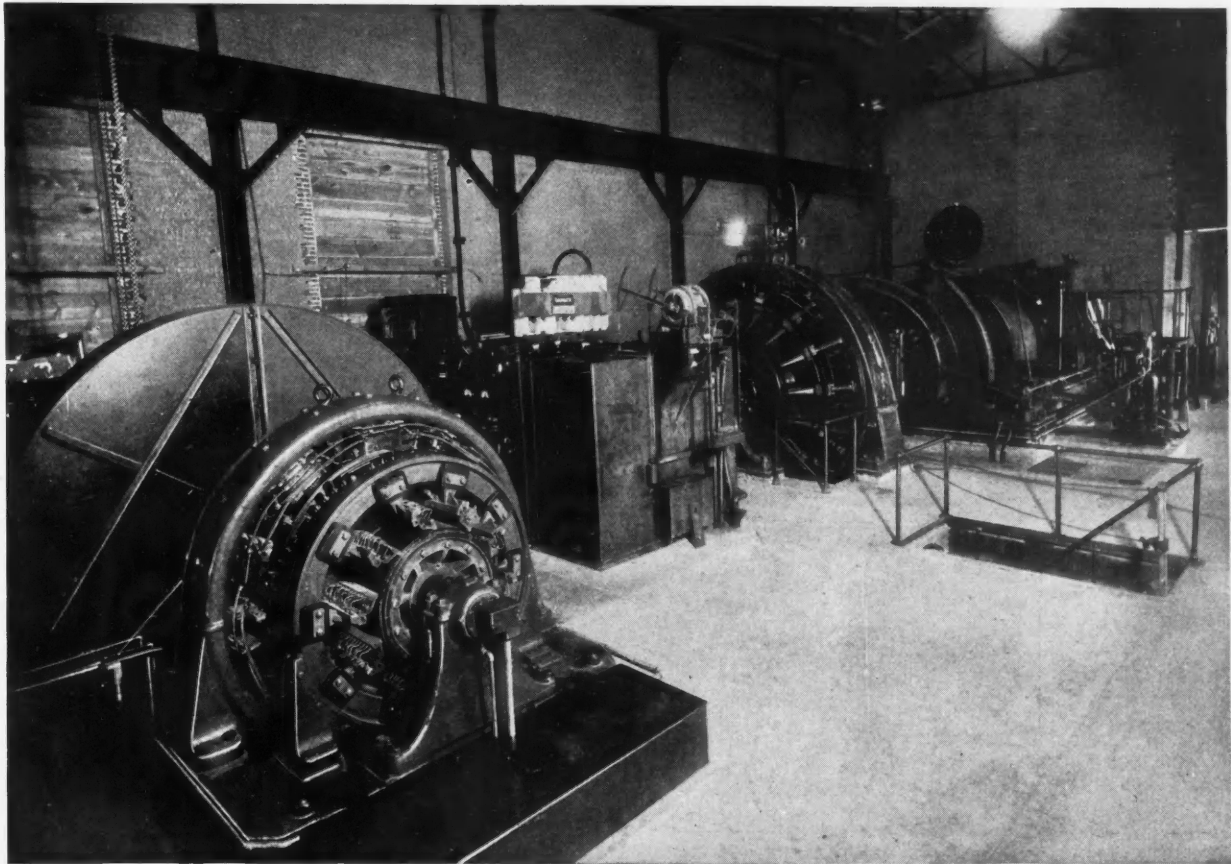
Surface coarse-crushing plant, showing apron feeders, ore bin, and gyratory platform



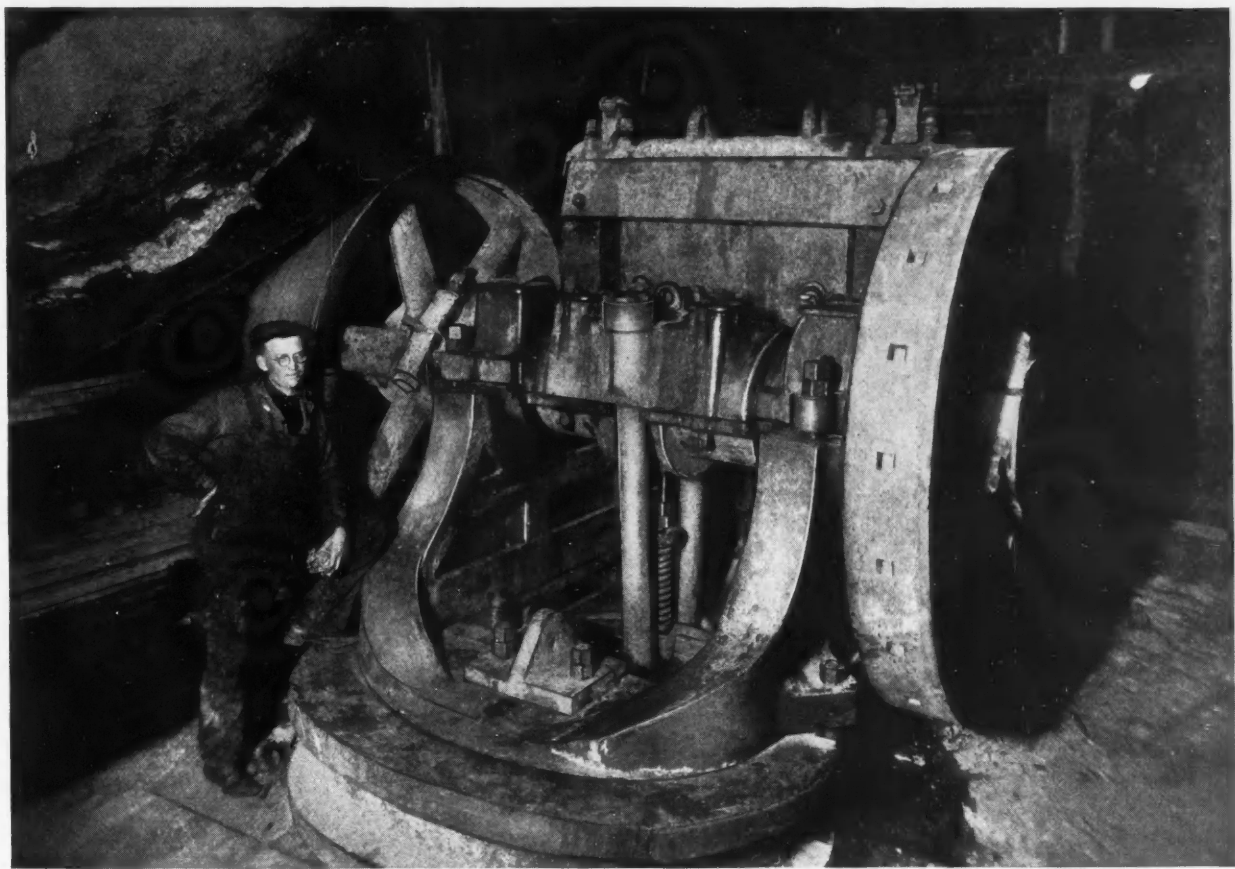
Magnetic pulley, trommel with cast-iron plates, and mouths of additional gyratories



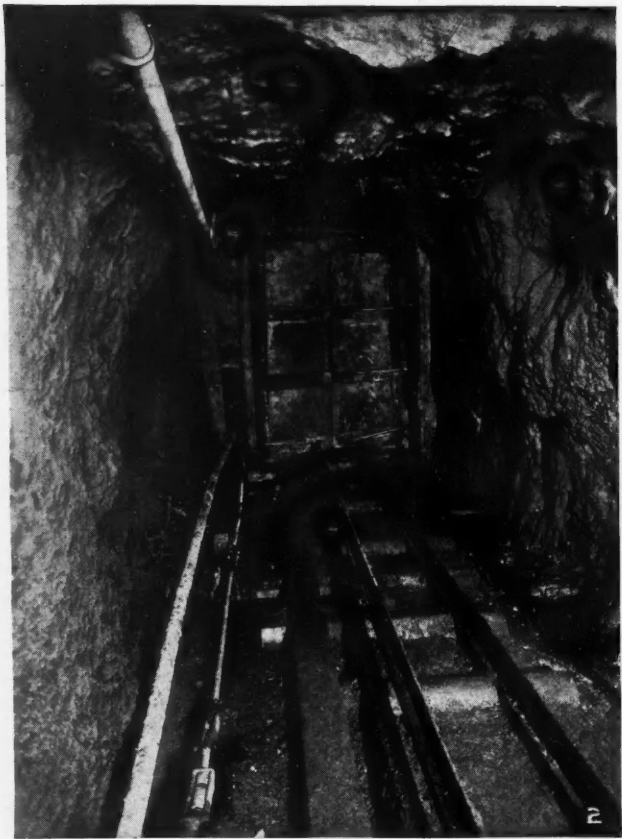
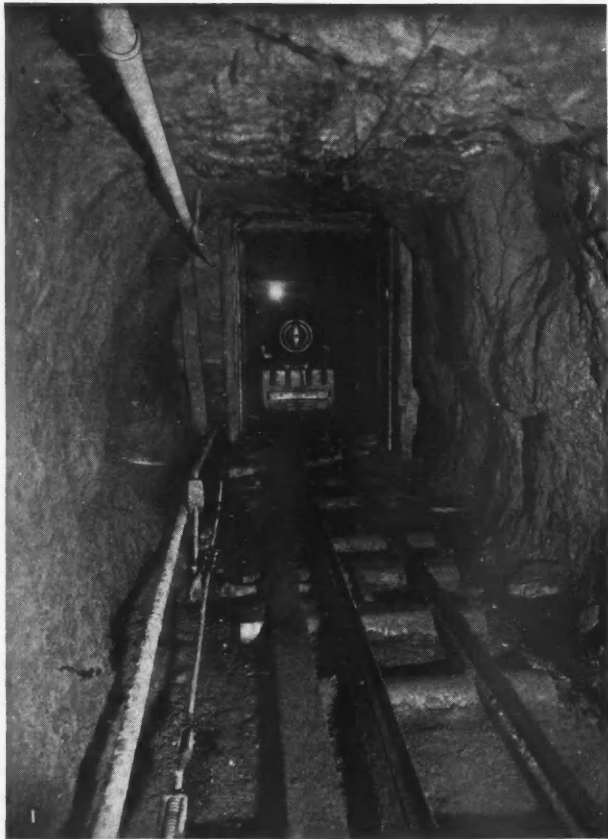
1—Loading pocket assembled on the surface. 2—Manganese steel sheave. 3, 5—Two views of new seven-ton skip. 4—Old style slender skip used in B & M shaft



Electric hoist at Ellison shaft



Jaw crusher used at 800 level



1 — Compressed-air locomotive passing through automatic mine-door. 2—Automatic mine-door in closed position.



3—Ventilating fan used underground. 4—Charging a compressed-air locomotive underground.

CONSULTATION

The Deviation of Plumb Lines from the Vertical

"Please tell me if it is true that plumb lines suspended in shafts for surveying purposes often do not hang true and are apt to show variations in the distance they are placed apart, throughout their length. Wasn't this effect observed in one of the Lake copper mines several years ago?"

Although it ought to be assumed that wire plumb lines suspended in a shaft with heavy weights attached to them provide little possibility for deviations in the distance between the plumb lines, many practical demonstrations have shown that they are occasionally so affected. Air currents and magnetic disturbances in the country rock are the chief trouble makers. The phenomenon was observed many years ago and the literature of surveying contains numerous examples of the divergence of long plumb lines. The cause has usually been traced to some simple interference, such as a pile of old rails or scrap iron in a crosscut near the shaft, or unsuspected air currents. In no example has any physical law been violated, and some logical explanation has always been found to account for the variations.

Perhaps the most striking example of this effect occurred over twenty years ago at the time Shaft No. 5 of the Tamarack mine, near Calumet, Mich., was being plumbed and was described in *Engineering and Mining Journal* by F. W. McNair. No. 24 steel piano wire was used and 4,250 ft. suspended in the shaft and weighted with 50 lb. cast-iron bobs. Great care was taken to see that the plumb lines swung free of the shaft, and then measurements of the distance between them at top and bottom of the shaft were made. The difference observed in the two measurements amounted to 0.11 ft.

Various explanations were advanced. The first conclusion reached was that the presence of iron pipes in one of the shaft compartments acted as a magnet and attracted the wire nearest to them. However, on plumbing the shaft a week later with lead instead of iron weights the same discrepancy was noticed, thus eliminating the magnetic theory. Another suggestion took into consideration the closer proximity of the walls of the shaft to one plumb line than to the other, but this attraction was not strong enough to account for the large deflection. A further suggestion was to the effect that the iron bobs were of like polarity and repelled each other. Air currents were also held to be responsible, but it was thought to be unlikely that they alone would account for the large deflection.

In order to ascertain the reason for the effect, another shaft was plumbed, Shaft No. 4, of almost equal length but freer from magnetic materials than No. 5. No. 20 B. & S. gage phosphor-bronze wire and lead bobs, steadied in oil and water, were used. Measurements taken at three-day intervals gave results showing a convergence rather than a divergence of the wires at the bottom of the shaft. The convergence averaged about 0.02 ft. This result seemed to offer experimental evi-

dence that the plumb lines were not subject to magnetic repulsion and that the attraction of the walls did not act to spread the wires.

Bronze wires were then used to re-plumb Shaft No. 5, but a larger divergence than before, or 0.14 ft., was obtained. Only one explanation remained—the effect of air currents. Accordingly, the top of the shaft and all side openings entering it from the various levels were closed. The wires were re-hung, and new measurements showed an agreement between top and bottom horizontal distances to within 0.02 ft.

It has been shown experimentally that plumb lines are subject to deflection if an air current traveling faster than 100 ft. per minute is present in the shaft. Extreme care should be taken in plumbing any shaft to see that no air currents are allowed to play in the shaft. If necessary the ventilating currents, which are nearly always present in a shaft, should be reduced or completely stopped while plumbing is being done. If magnetic influences are present, it is best to use some non-magnetic material for both plumb bobs and lines.

The Value of Germanium and Its Market Possibilities

"Several mining companies operating on a large scale in Mexico, and in which I am heavily interested, have been developing a large deposit of germanium. One of the deposits contains large quantities of the metal as oxide and sulphide assaying up to 30 per cent. I would greatly appreciate any information you may give me regarding the present market value of the metal and if possible the names of concerns who would be interested in the purchase of the ores or the finished product, which can be easily delivered to the near-by railroad."

Germanium is a metal belonging to the same chemical family as carbon, silicon, tin, and lead. It is one of those elements whose discovery was predicted long before the actual isolation of the metal took place. Germanium is of extremely rare occurrence, and according to Dana, is found in the mineral argyrodite, which is a silver sulpho-germanate that has been found in Saxony and Bolivia. The specific gravity of germanium is 5.496, and it melts at 900 deg. C. It burns at a red heat and is insoluble in hydrochloric acid, but dissolves in aqua regia. It is also soluble in molten alkalis.

The amount of germanium produced in the world is exceedingly small. There is no regular market for the metal, nor have any uses been developed for it that would encourage a steady output. So far as we are aware, germanium mainly finds its way nowadays into laboratories for experimental work and has no important commercial application. Hence *Engineering and Mining Journal-Press* does not quote prices on the metal. Prices that may be set are largely nominal. Anyone contemplating producing germanium should carefully investigate the market for the product and enlist the services of governmental agencies, such as the Bureau of Mines and the Bureau of Standards, in an effort to evolve uses for the metal.

THE PETROLEUM INDUSTRY

Arbon and Rockland Valleys, Idaho, Offer Petroleum Possibilities

Cautious Prospecting Recommended by State
Bureau of Mines and Geology—Promising
Structures and Formations Present

ACCORDING to a report just issued from the office of Francis A. Thomson, dean of the School of Mines of the University of Idaho and director of the State Bureau of Mines and Geology, certain of the areas in Bannock and Power counties, in southeastern Idaho, near Pocatello, examined during the last summer by Virgil R. D. Kirkham, the bureau's petroleum geologist, appear to have petroleum possibilities, though others are unlikely to become petroleum producers. Arbon Valley and Hawkins Basin are discussed in Part I of the report, and the Mink Creek, Portneuf, and Rockland regions are covered in Part II.

The conclusion reached by the report is that although the Hawkins Basin, Portneuf Valley, and Mink Creek regions offer little or no promise, owing to the fact that the geologic formations are either volcanic ash or sediments so altered and disturbed as to preclude the existence of petroleum, on the other hand the Arbon Valley and Rockland areas show petroliferous possibilities. In the latter areas the formations and structures which have produced oil elsewhere appear to be present.

Arbon Valley lies in Power and Oneida counties. The geological beds of this area can likewise be divided into two groups, widely separated in age. The older series is made up of Carboniferous limestones. The Brazer limestone of the Mississippian division of the Carboniferous was definitely identified by a large group of coral and brachiopod fossils collected from the beds along the valley walls.

The younger group is of Quaternary age and consists of tuff, ash, sandstones, shales, and conglomerates, evidently of aeolian and lacustrine (lake) origin (wind-blown). This lake-bed material acts as a mask in covering the valley, and no hint of structure can be obtained except by examining the escarpments produced along each side of the valley by erosion. The region presents enough of the essentials mentioned above to indicate possibilities of petroleum production.

The limestone and shale in the area are of marine formation, as evidenced by the fossils, and are also of an age favorable to oil production. The majority of the eastern and mid-continental fields of the United States obtain good production from Carboniferous strata, although production from Carboniferous beds in the Rocky Mountain district has not been so general and has been limited to one field in Wyoming and one in central-eastern Montana.

Limestones can be and often are the reservoir rocks of large producing fields. This is the condition in Mexican fields where initial production is so great. Shale layers are interbedded in the limestone above the horizon, where drilling is likely to penetrate and where

the closure has been truncated by erosion. It is not unreasonable to assume that a recurrence at a lower horizon exists to serve as a capping layer.

A good anticlinal dome structure is outlined by the escarpment of the valley walls. Should oil exist in the underlying beds, this structure, which has closure in the lower horizons, would have an immense gathering ground. One feature which negates somewhat the main favorable essentials is the presence of much faulting in near-by areas. The limited time spent in the reconnaissance did not permit the discovery, identification, or tracing of any faults which may exist. The area in general presents most of the features of the Phosphoria area in Caribou County, discussed in Bulletin No. 4, of the State Bureau, entitled "Petroleum Possibilities of Certain Anticlines in Southeastern Idaho."

There are in the state areas of greater promise, but there are possibilities in Arbon Valley, according to Mr. Kirkham. This region is being tested by a well belonging to the Idaho Research & Development Co., of Pocatello, Idaho. As yet the drill has not passed through the covering of volcanic and lake-bed material, and the operators can expect no results until after penetrating the underlying Carboniferous limestone.

The area in Rockland Valley which was investigated lies in Township 9 S, R.31 E., and 10 S, R.31 E. Geological conditions here appear similar to those in Arbon Valley, a few miles to the east. The older beds are Mississippian limestone, with layers of carbonaceous fossiliferous shales, probably Brazer in age. The structure appears to be like that in the Arbon Valley anticlinal dome, except that closure is not certain on the north, where all the older rocks have been removed by erosion or covered by Quaternary lake-bed material and lava. The valley proper is covered entirely by ash, conglomerates, ashy clays, and tuffs (of apparently lake-bed material), with flows of basalt intercalated and overlying the various Pliocene deposits. As in Arbon Valley, these beds may conceal the true nature of the structure of the region. What appears to be an eroded dome with dips in opposite directions may be the result of faulting; but only painstaking detailed study could reveal the presence of faulting.

A source of origin for oil is present in the Carboniferous limestones and carbonaceous fossiliferous shale. A structure appears to be evident that presents a large gathering ground for any possible oil. The limestones serve as a reservoir or containing rock; shales are present that could serve as the capping rock. Sufficient deep-seated springs offer evidence of water saturation to enforce concentration of any oil.

In summary, enough of the factors and essentials of petroleum accumulation are present to justify more detailed geological work on the area, followed by a prospecting test. A local oil company in Rockland is securing leases, preparatory to investigating the region.

Concerning the petroleum possibilities of the Mink Creek, Portneuf and Rockland areas, Mr. Kirkham concludes that these areas are unfavorable for testing.

New Books

Silver from 1914 to 1920

L'Argent-Métal. La Hausse des Cours de 1914 à 1920. By André Pailhas. Paris, Librairie Générale de Droit et de Jurisprudence, 1922.

This is a most clear, valuable, and scholarly study of the effects of the World War on the movement and markets of silver.

Up till the time of the war, the writer observes, the principle of the gold standard having almost universally triumphed, the silver question was at best of minor interest. But the war affected silver keenly.

The first chapter of the book is a clear and well-informed discussion of the mineral deposits which are the sources of silver. The gradual decline of the world's production from 229,000,000 oz. in 1911 to 170,000,000 in 1920 is noted, and that this decrease was during a period of general rising prices for silver. Canada, Australasia, Mexico, and the United States are taken up in separate chapters.

The second division deals with the demand for silver. Among the industrial uses, photography is held to be most important; but the industrial uses of silver, though they consume the larger part of the production, the author finds difficult to evaluate closely; in any event, he finds that the market fluctuations of the metal have depended mainly upon other elements, such as the purchases of the various mints of the world, especially those of India and China. A chapter is given to the minting of silver by the occidental countries, showing the increased demands for small coinage during the period 1915-18. However, hoarding of silver, and the insatiable demand for small coin, led different governments to the use of substitutes; for finally the rise in prices of the metal brought on by this demand brought the metallic value of silver coins in most countries above their face value.

The demand of India is analyzed at length. In 1913-14, India imported one-third of the world's total silver production. Hoarding of silver in India has a climatic as well as an economic explanation. The war introduced violent fluctuations into the demand, but in 1918-19 the silver imports amounted to the enormous figure of nearly 234,000,000 oz., or a little more than the world's total production. At the end of 1918, through the exigencies of the war, the government of India found itself almost stripped of silver rupees and unable to substitute paper money to the extent that the European powers were doing. At it was, the fiduciary currency had increased 44 per cent from the middle of July to the end of 1917, while the cover of silver rupees had fallen from 45 per cent to 15 per cent. Under these circumstances Great Brit-

ain arranged for the loan of silver from the United States, authorized by the American Congress under the Pittman Act. "This measure saved India from a very serious crisis."

In another chapter "the complexity of the monetary problem in China" is analyzed. Among other things, it is shown that the Chinese demand for silver "was one of the preponderating factors in the rise of the price of silver in 1919" (p. 105); and it is further shown how "China, which was the principal cause of the rise of silver from July, 1919, to January, 1920, still remained the effective support of the market during the third quarter of 1920" (p. 137).

The third part of the book takes up the problem of silver stocks. The most available sources of information, the writer states, are the reports of the United States Mint; nevertheless, he is inclined to regard these reports as unreliable. With this comment, he quotes the Mint's estimate of a total stock of \$2,125,760,000 in the world, exclusive of China, at the end of 1914. The Pittman Act and the melting down of silver coin and plate in 1919 are separately treated in brief chapters.

The fourth part of the volume discusses markets and prices. London as the world's principal silver market is explained. New York is considered a minor market only, by virtue of its situation in a producing country; it "limits itself to translating into the currency of the country the prices cabled from London." The rise in the price of the metal is studied step by step, through the Anglo-American government control of the market in 1918, the release of this control in May, 1919, and the immediately subsequent soaring of quotations, up to 76d. on Nov. 25, and over 88d. in the early part of 1920. Thereupon the United States Government offered for sale in Shanghai a portion of the silver dollars released by the Pittman Act. This was the signal for the course of prices to turn and to become lower, to which decline many other factors contributed, such as the virtual cessation of the Indian and Chinese demands. The fall in price below \$1 per ounce initiated the two prices of silver in New York.

As to the "future of silver" (p. 185), the author points out that the turbulent vicissitudes of the war period led many governments to substitute other metals and paper for silver, for use in small coinage. Also, the development of the Far East will gradually increase the use of gold and diminish hoarding.

"The history of past centuries traces a curious evolution of the rôle of silver in the world. The development of civilization and wealth in the western countries brought about at first a corresponding increase in their demand for silver. Then this metal appeared incapable to suffice to assure transactions of increasing value, and it was supplanted by gold. Such an evolution may take place in the Far East, and perhaps there will come a period when silver will have none but industrial uses. However long this evolution may be,

the events of these last years will nevertheless have marked an important step in the history of silver."

J. E. SPURR.

Micropetrography

Essentials for the Microscopical Determination of Rock-forming Minerals and Rocks. By Albert Johannsen. The University of Chicago Press, 1922. \$2.10.

As stated in the preface, "The laboratory manual contains practically all the data originally published in the writer's 'Determination of Rock-forming Minerals,' and in addition gives modes of occurrence and many other points of separation between similar minerals." By uniting some tables and otherwise avoiding duplication, by omitting most of the sections on the mineral groups, and by a more compact arrangement, the number of pages has been materially reduced. The section on optical methods has been much reduced and a section on the determination of rocks has been added.

The minerals are arranged in groups according as they are opaque, isotropic, or anisotropic, and the latter are subdivided into colorless, or colored, pleochroic or non-pleochroic, uniaxial, or biaxial. The minerals of each group are plotted on a diagram according to their bi-refringence and index of refraction. They are also described in the text on the adjoining pages. This arrangement and the conciseness of the data should prove helpful to students and to those who use the microscope only occasionally.

The sections and tables on the determination of the feldspars are probably the best concise treatment of their determination available. It is regrettable, however, that for the Michel-Levy method the old diagram has been used. Determinations made by this diagram are commonly in error as much or even greater than 10 per cent, whereas by using the diagram published by Wright the determinations check with those made by other methods.

The section on a summary of petrographic methods is an excellent summary, but it is too brief to serve any other purpose. Even an elementary understanding of the subject would require supplementary lectures or reference to another book. The alphabetical list of rock-forming minerals, giving their chemical composition and more important properties, should be very useful, but it is in such fine print and so crowded that it is difficult to read.

In the section on rock classification, Johannsen uses his recently proposed quantitative mineralogical classification. Though this has many excellent features, it is as yet difficult to get petrographers to agree on any new system of classification, and I believe it is best for elementary students to learn first the commonly used classification.

The book is well printed, the illustrations are excellent, and the essential data on the subject are clearly given in remarkably few pages.

ESPER S. LARSEN.

Recent Patents

Differential Flotation—No. 1,421,585. G. E. Sheridan and G. G. Griswold, Jr., Butte, Mont. An ore containing lead sulphide and one or more other sulphides, including iron sulphide, is treated with a cyanide and an alkaline salt before floating. The lead sulphide is largely recovered in the resulting froth, but the flotation of the iron sulphide is in large measure inhibited.

Electrostatic Separator—No. 1,422,026. G. R. Brown, Bondi, near Sydney, New South Wales, assignor to Electrostatic Separation Co., Ltd., Sydney, N. S. W. The hot dry material is centrifugally cast against an electrode, whereby its particles of comparative electrical conductivity become electrically charged and, by further treatment, are separated from the remaining material.

Potash Silicates—Canadian patent No. 224,058. The Potash Extraction Corporation, New York City, assignee of Walter Glaeser, Brooklyn, N. Y. Finely ground potash-bearing silicate and a water-soluble metal chloride are mixed, dried, and heated out of contact with the air to a temperature above 900 deg. C. The silicate and chloride may be present in equal amounts, and 5 per cent of a reducing oxide of iron may be added before drying and heating. Or, anhydrous silicate and anhydrous calcium chloride may be heated to a temperature of 800 to 900 deg. C. Patent No. 224,057 covers the treatment of ferrous alkali silicates by a similar method.

Chlorination—Canadian patent No. 224,039. Kalmus, Comstock & Westcott, Inc., Boston, assignee of E. W. Westcott, Niagara Falls, N. Y. Arsenical cobalt or nickel ores containing iron or silver are ground and treated with chlorine gas at a temperature not above 600 deg. C., or at such a point as will permit volatilization of arsenic and iron as chlorides while not permitting volatilization of chlorides of cobalt, nickel, and silver.

Electrolytic Extraction—Canadian patent No. 219,494. H. H. Godfrey, Los Angeles. A vessel carrying anodes and cathodes separated by porous diaphragms, and means for giving a reciprocating motion to the whole.

Chloridization—Canadian patent No. 219,519. The International Precipitation Co., assignee of W. A. Schmidt, both of Los Angeles. A method of adding a metallic halide to ores during successive stages of roasting, by which the valuable metals in the ore are volatilized.

Powdered Coal—Canadian patent No. 219,655. E. H. Hamilton and L. W. Kirk, Midvale, Utah. A method of introducing pulverized coal into a blast furnace, by which the coal and air blast do not mix until they are within the furnace walls.

Societies, Addresses and Reports

Duluth Mine Safety Conference Program Announced

The program, as announced for the Lake Superior Mine Safety Conference held at Duluth, Minn., Oct. 26 and 27, was as follows:

An address by C. L. Colburn, Washington, D. C., representing the National Safety Council and the Bureau of Mines.

"Practical Safety Measures in Underground Timbering," by Ed. Smith, mine inspector, St. Louis County, Minn. "Safeguarding Underground Water Supplies for Use in Mines," by J. A. Childs, engineer, Minnesota State Board of Health.

"Engineering Problems Encountered in Mine Ventilation," by W. H. Carrick, engineer, U. S. Bureau of Mines, Houghton, Mich.

"Physiological Research of Miners Working in Poorly Ventilated Mines," by Dr. F. V. Meriweather, Bureau of Mines, Houghton, Mich.

"Latest Developments in Mine Rescue Apparatus," by D. J. Parker, chief engineer, mine safety service, Bureau of Mines, Pittsburgh, Pa.

"The Influence of Accident Prevention by the Wisconsin Plan," by R. A. McKeown, engineer, industrial commission of Wisconsin, Madison, Wis.

"Re-education of Disabled Employees," by Oscar M. Sullivan, director of the division of reduction, Minnesota Industrial Commission, St. Paul, Minn.

"Open Pit Lighting and Its Relation to Prevention of Accidents," by W. G. Brown, superintendent, Albany mine, Hibbing, Minn.

"Safe Practices and Devices Used by Railroads That Can Be Applied to Open Pit Operations," by A. V. Rohweder, safety director, D. M. & N. R.R., Duluth, Minn.

An address by W. H. Moulton, Cleveland-Cliffs Iron Co., Ishpeming, Mich.

B. D. Shove, safety inspector for the Oliver Iron Mining Co., Ironwood, Mich., was also on the program to present a paper.

New Mexico Chapter of Mining Congress Elects Officers

The New Mexico Chapter of the American Mining Congress elected the following officers at its second annual meeting, held in Silver City on Oct. 2:

Governor, John M. Sully, Santa Rita; first vice-governor, S. J. Kidder, Mogollon; second vice-governor, Powell Stackhouse, Jr., San Antonio; third vice-governor, George A. Kaseman, Albuquerque; treasurer, Ira L. Wright, Silver City. Directors are: C. T. Brown, E. M. Sawyer, John M. Sully, Ira L. Wright, Powell Stackhouse, Jr., B. B. Hanger, S. J. Kidder, L. M. Kniffen, Frank W. Vellacott, I. J. Stauber, J. B. Gilchrist, H. C. S. Anderson, George A. Kaseman, and V. Carl Goubnan.

Business sessions occupied both the morning and the afternoon. H. C. S. Anderson read an interesting paper on "Sponge Iron and Its Relation to the Copper Industry," and Percy Wilson told of the effective work done by the chapter in assisting in the interpretation of the 1921 laws, affecting the valuation of New Mexico mines, when acted upon before the State Tax Commission.

Dr. John D. Clark, of Albuquerque, presided as toastmaster at the banquet, at which the speakers responded to the toasts opposite their names, as follows: John M. Sully, "The New Mexico Chapter"; E. M. Sawyer, "The Future of Copper"; L. M. Kniffen, "The Interdependence of Coal and Metal Mine Operator"; and Ira L. Wright, "Something About Silver."

Bureau of Mines Will Study Use of Oxygen in Metallurgy

With the purpose of conducting systematic studies as to the application of oxygenated air to metallurgical industries and their problems, a special committee has been appointed which will co-operate with the Bureau of Mines in an extended course of experimentation. The work of the committee has been divided in two parts, as follows:

1. Study of present-day processes for the production of oxygen, in order to determine the feasibility of attempting to produce oxygen or oxygenated air, in such amounts and at such a cost as to permit of its use in metallurgical operations.

2. A study of the feasibility of using oxygen of oxygenated air in metallurgical operations to increase efficiency and thus bring about the production of metals at a lower cost, and possibly from lower-grade ores.

The members of the committee follow: F. G. Cottrell, director Fixed Nitrogen Research Laboratory, Washington, D. C.; W. L. DeBaufre, chairman Mechanical Engineering Department, University of Nebraska, Lincoln, Neb.; D. A. Lyon, chief metallurgist, Bureau of Mines, Washington, D. C.; R. B. Moore, chief chemist, Bureau of Mines, Washington, D. C.; R. C. Tolman, professor of physical chemistry and mathematical physics, California Institute of Technology, Pasadena, Calif.; J. W. Davis, mechanical engineer, Bureau of Mines, Washington, D. C.; F. W. Davis, metallurgist, Bureau of Mines, Minneapolis; Frank Hodson, president Electric Furnace Construction Co., Philadelphia; P. H. Royster, assistant metallurgist, Bureau of Mines, Minneapolis; and M. H. Roberts, vice-president Franklin Railway Supply Co., Inc., New York.

Inquiry is to be made of the commercial concerns engaged in producing oxygen with a view to obtaining data as to the lowest cost at which it reasonably may be expected to produce oxygen. A careful analysis of processes is to be made in the hope that improvements may be discovered which will reduce costs of production.

MEN YOU SHOULD KNOW ABOUT

Fred S. Norcross, Jr., is in New York.

S. F. Shaw is inspecting the Sultana mine, near Viesca, Coahuila, Mexico.

John Wellington Finch will spend the winter in New York.

G. W. Stose, of the U. S. Geological Survey, is doing field work in Pennsylvania.

Sidney Paige, of the U. S. Geological Survey, is continuing his work in the Homestead region of the Black Hills.

Frederic R. Weekes has returned from the Northwest and has left New York for California on professional business.

S. G. Taylor, formerly secretary and treasurer of the Judge Mining & Smelting Co., has been visiting in Salt Lake City.

Charles Stutts, of the U. S. Geological Survey, is doing co-operative work with the Alabama and Tennessee surveys.

Cleveland Dodge, Jr., is making an official visit to the Phelps Dodge properties in Mexico, Arizona, and New Mexico.

Samuel Shapira, mining engineer of New York, is spending two weeks at Regina, Saskatchewan, on professional business.

F. G. Stevens has been appointed consulting engineer for the Consolidated West Dome Lake Co., of Porcupine, Ontario.

Walter A. Rukeyser, mining engineer, is making a trip through the Southwest and Mexico on professional business.

E. J. Atchison, of the Southwestern Engineering Co., of Los Angeles, will spend the next few months in New York on professional business.

P. F. Walch, general manager of the White Syndicate Special, owners of the Last Chance mine, at Lordsburg, N. M., is in Denver on company business.

Dorsey A. Lyon, chief metallurgist of the Bureau of Mines, is at the Minneapolis experiment station supervising test runs on the new blast furnace.

D. C. Jackling and **Horace V. Winchell**, president and director respectively of the Mesabi Iron Co., recently visited the company's plant at Babbitt, Minn.

J. Gordon Hardy, former consulting engineer for the American Smelting & Refining Co., has been making an investigation of the Kirkland Lake gold field.

Captain Samuel Jewell, in charge of underground operations for the Wharton Steel Co., at Dover, N. J., is in the Lake Superior region on business.

George S. Rice, chief mining engineer of the U. S. Bureau of Mines, is in California conferring with the special state committee which is investigating the Argonaut disaster.

C. J. Stover was recently appointed president and managing director of the Consolidated Asbestos Limited, at Montreal. Mr. Stover was formerly editor and publisher of *Asbestos*. He entered the asbestos business in 1906 as bookkeeper for the Keasbey & Mattison Co., at Ambler, Pa., and became successively accountant, sub-branch manager, department head, and vice-president. In 1917 he went to Philadelphia as secretary for the Allied Asbestos Trade Associations, and served during the war as a medium between the asbestos magnesite industry and the War Industries Board. In 1919 he began publishing *Asbestos*. Mr. Stover is a member of several Pennsylvania clubs and fraternal orders.



C. J. Stover

Dr. F. W. McNair, president of the Michigan College of Mines, of Houghton, is in New York to attend important meetings in the interest of the advancement of engineering education.

J. C. Greenway, general manager of the Calumet & Arizona Mining Co. and the New Cornelia Copper Co., has returned to Warren, Ariz., from a visit to the Clifton-Morenci district, and to the 85 mine, at Lordsburg, N. M.

William A. Kerr and **S. A. Holman**, vice-president and manager, respectively, of the Balaklala Consolidated Copper Co., recently visited the properties of this company at Republic, Wash.

J. A. Ackroyd, of Boston, assistant secretary and assistant treasurer of the Copper Range Co. and Copper Range R.R. Co., is in the Michigan copper district on a visit to the companies' properties.

D. E. Woodbridge, of Duluth, and **F. W. McKelip**, of Faribault, Minn., were visitors recently in Chicago, where they attended the annual meeting of the Council of State Boards of Engineering Examiners as representatives of the State of Minnesota.

E. S. Boalich, who has served as chief mining engineer of the California State Mining Bureau, at San Francisco, for the last five years, has taken the position of valuation engineer in the Income Tax Unit of the Treasury Department, at Washington, D. C.

J. W. Furness, mining engineer, of Philadelphia, has been appointed consulting engineer in the Bureau of Mines and will work largely in co-operation with the newly organized War Minerals Supply Division of the Bureau in making studies of certain strategic minerals, especially manganese, on which he is an authority.

Dr. Bruce Rose, a graduate of Queens and Yale Universities, has been appointed to the mineralogy and geology department of Queen's University, Kingston, Ont. He was for six years a member of the staff of the Canadian Geological Survey and latterly has carried on investigations for the Whitehall Petroleum Co., of London.

Alfred D. Flinn has been elected a director of the Engineering Foundation. Mr. Flinn is the first incumbent of the new post, created by the foundation's governing board, composed of the Four Founder Societies of civil, mining, mechanical, and electrical engineers, to meet the expanding activities of the foundation. Mr. Flinn will retire as chairman of the engineering division of the National Research Council, a position which he has held since October, 1921, but will continue as secretary of the United Engineering Society in order that the foundation may continue intimate relations with the Founder Societies. Mr. Flinn has been secretary of this society and of the foundation since January, 1918.

Mr. Flinn, a resident of Yonkers, is a native of New Berlin, Pa., and a graduate of Worcester Polytechnic Institute in 1893. He has been identified with municipal engineering enterprises in New York and Boston and was formerly a lecturer in the Lawrence Scientific School of Harvard. He has been associated as editor with technical journalism and as the author of numerous books and articles on engineering and science. At Worcester he was the Salisbury prize winner.

Mining and metallurgical engineers visiting New York City last week included: **Walter X. Osborn**, of Gila Bend, Ariz.; **Harry P. Hill**, of Austin, Tex.; **James A. Smail**, of Youngstown, Ohio; and **William Kelly**, of Vulcan, Mich.

OBITUARY

Herbert S. King, superintendent of the North Chandler Mining Co., at Ely, Minn., was accidentally shot and killed when hunting on Oct. 15.

Sir John W. Carson, president and managing director of the Crown Reserve and Porcupine Crown mining companies, died at Montreal on Oct. 13.

THE MINING NEWS

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

Leading Events

THE Salt Lake Insecticide Co. is completing a plant for recovering the arsenic in ore from the Western Utah Copper mine, as calcium arsenate. The product will be used to fight the boll weevil in Southern cotton fields.

Inconsistencies are noted in the testimony given by officials of the Industrial Accident Commission in investigation of fatal Argonaut mine disaster.

Railroad shop strike—still on—threatens to stop mine operations in Colorado. Locomotives are out of repair.

Greatest rush in history of South Africa follows the opening of new diamond diggings.

Strike of high-grade ore in the Keeley mine, Cobalt

district of northern Ontario, is said to eclipse any recent discovery.

The U. S. Land Office rules in favor of mineral claimants in contest with forest service in Coeur d'Alene district of Idaho.

Shipments of Texas sulphur increased 60 per cent during last fiscal year.

Officials see need for helium as the only desirable gas for dirigibles.

The Federal M. & S. Co. has started, through its subsidiary, new operations in the Joplin-Miami district.

The Bunker Hill company has completed a model power plant at Kellogg, Idaho.

Hitch, Not Breakdown, Says Russo-Asiatic Official

Non-Ratification of Agreement for Return of Mining Properties Does Not Cancel It

According to Reuters, the Soviet Government of Russia officially published on Oct. 7 the resolution, signed by Lenin, annulling the concession to the Russo-Asiatic Consolidated, which was signed in Berlin by Krassin and Leslie Urquhart, the chairman of the company. The reason assigned was that Great Britain had not established friendly and regular relations with Krassin and that she had not recognized the right of Krassin to take part in the discussion on Near Eastern questions.

While confessing disappointment at the non-ratification, Urquhart insisted that the last word on the subject had not been said. For the moment politics had been injected into business, with the usual results. But he felt sure that politics would be put in their proper place when the rulers of Russia realized the greatness of the shock they had administered to the confidence of the business world and how impossible they had made it for foreign capital to re-enter Russia on any such basis. That his agreement would before very long be duly ratified and acted upon he did not doubt. What had happened was a hitch; it was not a breakdown. He said "The agreement has not been denied ratification on its merits as a business contract. It has been denied ratification simply and solely because of politics, and foreign politics at that. The official statement of the Russian Government makes that quite clear. It would appear from

it that by withholding ratification the Russians thought they saw a chance of inducing Great Britain to recognize the Soviet Government or to include its representatives in the coming conference on the question of the Straits, or something of that sort."

With reference to the reports published in London that the leading German newspapers have been conducting a campaign against the ratification of the Russo-Asiatic agreement, and that German agents in Moscow have been doing their best to bring about its rejection, a semi-official statement issued in Berlin declares, says Reuters, that the German press has recently unanimously advocated the ratification of the agreement, as German interests are involved in it, and strong representations have been made from German quarters to the effect that its rejection might be detrimental both to Russia's economic life and to German activities in that country. It is added that the same view was stressed by German interests in Moscow itself.

Dolcoath Tin Mines Financed

By Cable from Reuters to "Engineering and Mining Journal-Press"

London, Oct. 21.—The Dolcoath Tin mine, Camborne, Cornwall, has decided to provide £70,000, which, with the Trade Facilities Board's grant of £50,000, raises the capital required for developments at the mine. The company proposes to sink a new vertical shaft and to add to the mine's equipment. Whether it will be possible to revive tin mining in Cornwall remains to be seen.

Governor's Committee Investigates Argonaut Disaster

Mine Fire That Killed Forty-seven Subject of Inquiry—Statements of Officials Appear Inconsistent

The first public hearing of testimony by the committee appointed by Governor Stephens to investigate the circumstances preceding and attending the disastrous fire at the Argonaut mine at Jackson, Calif., was held in San Francisco on Oct. 16. A. B. C. Dohrmann was appointed chairman; the other members are W. J. Loring and John C. Williams.

Will J. French, chairman of the California Industrial Accident Commission, first put upon the record a statement of the amount of money available for the enforcement of safety laws and for the education by the commission of the mining communities in safety work. The amount, he said, should be increased from \$18,000 to \$50,000 or \$100,000 per annum. He stressed the impossibility of adequate inspection with the present personnel of three safety engineers, a number that, he declared, should be increased to eight.

H. M. Wolfin, safety inspector for the commission, gave the date of the most recent inspection of the Argonaut mine as April, 1922, when he said everything was found satisfactory. The safety requirements comprised, he said, (1) the provision of extinguishers in the vicinity of powder magazines, (2) the provision of mine rescue apparatus, and (3) the holding of fire drills if the commission was of the opinion that a hazard existed. No question was put as to whether it was considered that

conditions at the Argonaut mine made the holding of drills advisable.

The commission, Mr. Wolfen said in answer to a question, has sufficient legal powers to enforce its regulations. Further inquiry elicited the evidence that the shift boss and skip tenders could probably have put the fire out had adequate apparatus been available.

Fred L. Lowell, assistant mine inspector on the commission's staff, in reply to a question as to the value of extinguishers, said that a good supply of water was preferable. He recommended the provision of a hose and connection for every 100 ft. of shaft. On the question of the stoppage or reversal of the fan at the mouth of the Muldoon shaft, Mr. Lowell said that all concerned were unanimous that the direction of the air currents should be maintained. He was on the property about 1 o'clock on the day after the fire broke out, thirteen hours after its discovery, and telephoned the commission's headquarters in San Francisco for instructions in regard to the operation of the fan. Continuance of suction down through the Argonaut shaft was advocated.

T. A. Rickard, in his testimony, pointed out the inconsistency in statements made by officials of the commission. If the funds at their command were inadequate, he asked, how was it that the mine had been inspected sufficiently and that all safety requirements had been met? He added that he had learned on good authority that one of the entombed men had telephoned to the surface after the fire was well under way and had inquired as to when the skip was to be sent down for them; he suggested that the committee investigate this. In discussing the question of the operation of the fan at the mouth of the Muldoon shaft, Mr. Rickard pointed out that reversal was clearly impracticable without a loss of several hours, but he was of the opinion that had the fan been stopped immediately or soon after the fire was discovered the Argonaut shaft would have become the upcast and the natural draft caused by the fire would have sucked the foul gases away from the men and would have created a current of air down the Muldoon shaft and into the lower workings of the mine, thus permitting the men to escape death by asphyxiation.

Federal Subsidiary Starts New Operation Near Miami, Okla.

The Lucky O. K. Mining Co., a subsidiary of the Federal Mining & Smelting Co., is preparing to start the mill of the Lucky Jennie mine, at Hockerville, Okla. It is now sinking a mill shaft at the property 40 ft. to the deeper ore level, and as soon as this operation is completed it will start the mill, which it has recently thoroughly overhauled. It is also erecting a derrick at a field shaft, about 200 ft. west of the mill, and will bring ore from this shaft over a surface railroad. P. W. George, of Baxter Springs, Kan., is manager.

Calcium Arsenate Plant in Utah Nearing Completion

New Enterprise to Make Salt Needed to Combat the Boll Weevil in Southern Cotton Fields

The plant of the Salt Lake Insecticide Co., which is being built at Salt Lake City to produce calcium arsenate from the ores of the Western Utah Copper mine, at Gold Hill, Utah, is approaching completion. In spite of delays in the arrival of machinery and material, it is hoped to begin the treatment of ore about the middle of December. A good demand for the material is expected; particularly as indications are that the supply of foreign arsenic is not nearly as large as has been estimated. Indicative of the growing need for the product, is the damage to the cotton crop of the south from the depredations of insects. The production of cotton has been reduced from 11,000,000 to 6,000,000 bales in the last six months, largely on account of the boll weevil, which can be combated with arsenic poison, according to the U. S. Department of Agriculture. Frank K. Cameron is originator of the process to be used, and manager of the plant.

Northern Ontario Silver Mines Get Reduced Express Rate

The Express Traffic Association, partly as a result of the efforts of the Ontario Mining Association, has granted reductions in the rates on gold and silver bullion from northern Ontario. Rates on gold bullion from Porcupine and Kirkland to Denver, Colo., have been reduced to \$5.45 and \$5.15 per \$1,000 respectively, a reduction of 60c. per \$1,000. To Ottawa the reduction is 20c. per \$1,000, the rates now being \$2.10 and \$1.80, respectively. Reductions on silver bullion to St. Johns and Halifax for export to England have been much greater, the new rate from Cobalt to either of these ports being \$5.60 per \$1,000, a reduction of \$2.30 per \$1,000.

Company Plans Exploitation of Mica Deposits in New Mexico

The American Mica Co. has purchased a number of inactive mica properties in Rio Arriba County, N. M., the principal one being that formerly owned by the Petaca Mining Co. Mining engineers have reported that they expect the Petaca mica field to be one of the largest in the United States and also that the mica produced will be of high grade.

The American Mining Co. expects to erect a grinding plant in Santa Fe. Low cost should be possible because of low wages. This company will endeavor to supply ground mica to western users and to some in the east-central states.

Heretofore the cutting and trimming in the vicinity of Santa Fe has not been satisfactory, because the company was unable to obtain the services of skilled workers, but under proper supervision

this condition can be overcome in some measure.

It is the intention of this company to install at once a number of punch machines for the manufacture of mica washers and disks for use in electrical insulation. The mica produced by these mines is muscovite of a light green color, flexible and free of iron.

These mines were originally worked by early Spanish settlers, who used the product for window glass. The padres used it also in the windows of the old San Miguel church, the oldest in America, which is still standing in Santa Fe.

Lake Copper People Correct Mistaken Rumors

Rumors have been circulated that one of the Lake mining companies will manufacture copper shapes near its properties in Michigan. It can be stated as practically a certainty, however, that if any Lake company does decide to fabricate its product, a plant will not be established at the mines but at some recognized manufacturing and distributing point.

Another report in circulation, both in Michigan and in the east, to the effect that important new discoveries of copper deposits have been made in the copper country, is without foundation. No discoveries out of the ordinary have been made. The development properties, such as Seneca, Arcadian, and Malflower-Old Colony, are making progress, but no exploratory work other than is done in the course of opening new ground in producing shafts has been undertaken.

Texas Sulphur Shipments Increase 60 Per Cent

Shipments of sulphur through Galveston and Texas City, loading terminals for the Texas Gulf, Union, and Freeport Texas companies, were 484,966 tons for the twelve months ended Oct. 1, against 296,931 tons in the preceding twelve months, an increase of over 63 per cent. These figures do not include shipments from Freeport, near Freeport, Texas, properties. Of this total 204,728 tons left for foreign and 280,238 for American points. For fiscal year ended June 30, 1922, total shipments were 493,965 tons, of which 320,642 went to coastwise points and 173,323 to foreign points. The small movement from Galveston in this period, of which 100,921 of 115,338 tons was coastwise and 14,417 foreign, was due to loss by fire of one of the principal loading plants during the year. The new 30,000-ton plant of Texas Gulf Sulphur Co., nearing completion, will have a loading speed of 600 tons per hour.

Asbestos Royalty Reduced

The Province of Quebec has acceded to the request of the asbestos producers and has reduced the royalty payable to the provincial government from \$5 to \$2.50 a ton.

News from Washington

By PAUL WOOTON
Special Correspondent

Helium Essential for Dirigibles

Bureau of Mines to Operate Plant for Economical Recovery—Recent Catastrophe Should Stimulate Action on Helium Bill

IN CONSEQUENCE of the destruction of the dirigible C-2, the War Department will probably direct that no further use of hydrogen be made in the inflation of ships of the dirigible type. According to the Bureau of Mines, enough helium is available at present to inflate three ships of the C-2 type. The Fort Worth helium plant is again in operation, which will make possible material additions to the present reserve. Though recovery in helium in that plant is costly, an effort is being made to increase the present reserve from 2,500,000 to 10,000,000 cu.ft. Another reason is that the gas from the Petrolia field, which is comparatively rich in helium, is now being burned, with the prospect that this unusually favorable source of supply soon will be exhausted.

Experiments conducted by the Bureau of Mines in its cryogenic laboratory have been so successful that a plant of semi-commercial size is to be built to demonstrate whether or not the laboratory method will work out on a larger scale. That plant will be in operation during the present fiscal year. All who have followed these experiments are hopeful that a great reduction in the cost of recovery will be found possible.

Before extensive use of dirigibles inflated with helium is attempted, it is probable that the ships will be redesigned. This can be done so as to result in considerable efficiencies. It will be possible to place the engines very close to the envelope, thereby greatly increasing their efficiency and making possible greater ease in the manipulation of the craft. There is every reason to believe that the fire hazard can be reduced until it is no greater than that inherent in the operation of an airplane.

It is admitted, even by the advocates of the lighter-than-air ship, that the present cost of recovering helium is prohibitive. They contend, however, that the operation of the Fort Worth plant is justified because of the indications that costs will be reduced in the near future.

The accident to the C-2 is certain to stimulate the consideration of the helium bill now before Congress. Hearings on this measure are to begin in November or December. This bill has received the approval of the President and of several members of the Cabinet. It proposes to centralize in the Bureau of Mines all matters pertaining to the conservation and production of helium. The Army and Navy is to be given first call on any supplies developed. The bill provides a revolving fund of \$5,000,000,

of which a part can be expended in the construction of a plant, the purchase of leases, and the conservation of existing supplies. The remainder is to be used as an operating fund. The helium produced is to be turned over to the Army and the Navy, which agencies are to reimburse the revolving fund. Any surplus not needed for military purposes can be sold or leased for commercial use. The bill also prohibits the export of helium.

Helium occurs in the gas of a number of American fields. It is estimated that enough of it is going to waste each day to fill a dirigible the size of the ZR-2. An indication that the recovery of helium at a cost which is not prohibitive is not regarded as improbable is apparent from the fact that rights to construct zeppelins in this country have been secured and construction is now in progress. The interests financing the project are considering the production and use of helium.

U. S. Coal Commission Will Keep Public Advised

Current Bulletins Will Reveal Evidence on Which Decision Is Based—Members Have Had Experience

The first act of the United States Coal Commission at its initial meeting on Oct. 18 was to designate John Hays Hammond as its chairman. The commission immediately plunged into a discussion of a program for its work. No formal announcement has been made as to how the work will proceed, but certain of its policies already are apparent. It is the intention of the commission to keep the public informed as to each step of its progress. It recognizes that in this way the public will be able to absorb more knowledge as to the problems of the coal industry. The commission recognizes that the only chance that it has to accomplish anything is to secure public support for its recommendations. It is believed that if the public mind goes through the same processes as the minds of the commissioners will go through, the people will be prepared to pass intelligent judgment on the conclusions. Frequently when conclusions constitute the first knowledge that the public has, much time must elapse before their real purport is understood. Thinking takes time. Recognizing that fact, the commission hopes to be able to carry the public along with it as the study progresses.

The first sessions indicated that President Harding's mixture of two engineers, two lawyers, two economists, and a newspaper man is altogether less

discordant than some critics might expect. Apparently they will work well together. Judge Alschuler gave early evidence that he is experienced not only in weighing evidence, but, as shown too in his packing house experience, is skilled in securing evidence for himself.

Mr. Marshall is so well known for his quaint philosophy and his Hoosier directness that sight frequently is lost of the very practical way in which he reasons on problems which come before him.

Dr. Smith, of the U. S. Geological Survey, brings to the commission not only his own large store of knowledge acquired from having kept abreast with the coal situation day by day for a long period of years, but his knowledge of the federal machinery and his acquaintanceship with the government personnel have made it easy for him quickly to co-ordinate the commission's book.

Mr. Howell has a wide acquaintance with men and has an accurate knowledge as to the part coal plays in the industrial South. He has demonstrated a keen appreciation of the public's equity in coal.

No one could approach a task better prepared to serve efficiently than Mr. Neill. It has been just twenty years since he began his work with the Roosevelt Anthracite Commission. His connection with the anthracite industry has been almost continuous since.

More War Minerals Awards

Subject to the approval of the Secretary of the Interior, the War Minerals Relief Commission has recommended awards in the following claims: J. W. Ferguson, Murphy, Calif., \$298; Joe Werry, Iowa Hill, Calif., \$639; Paine Bros. & Russell, Nevada City, Calif., \$389; Robert Belden, Belden, Calif., \$410.10.

The claim of the Merritt Development Co., which operated in Crow Wing County, Minn., was disallowed because no allowable loss was established. The claim of I. D. Garinger, of Daggett, Calif., was disallowed on the ground that it does not come within the act. The claim of James A. Ross, of Pleasant Grove, Calif., was disallowed for the same reason.

Government Sues to Recover on War-Time Contracts

Suit has been filed by the Attorney General against the Cleveland Brass & Copper Mills, Inc., and its sureties, to recover \$454,188.12, alleged to be due the government in connection with war-time contracts to which the Cleveland company was a party. The voluminous bill of complaint sets forth the transaction in detail and alleges that the Cleveland company became indebted to the United States in the course of negotiating contracts, gave notes in payment of this indebtedness, and afterwards failed to meet the notes. The Attorney General announces that this is the first of a series of suits to recover on war-time contracts.

Land Office Rules in Favor of Mineral Claimants

Forestry Service Criticized for Incompetence of Examiners in Adverse Proceedings in Coeur d'Alene

The criticism directed at the United States Forest Service by representatives of the mining industry in the West, on account of the persistent opposition interposed by the forestry service to the issuance of patents to mining claims on forest reserves, received substantial justification in a decision recently rendered by the commissioner of the General Land Office. The case involved patent to thirteen claims in the Coeur d'Alene mining district owned by George S. Auerbach, of Hartford, Conn. The application for patent was duly entered in the U. S. land office at Coeur d'Alene, Idaho, where protest was filed by the forestry service on the ground that the lands included in the group "are not mineral in character; that no discovery of a vein or lode of rock in place carrying valuable mineral deposits has been made upon any of the above named claims," and "that development work of the value of \$500 has not been performed" on seven of the claims.

On final appeal to Washington the adverse proceedings were dismissed as to nine claims. In the course of his decision the commissioner placed a severe indictment against the qualifications of mineral examiners sent out by the forestry service to report upon the character of claims offered for patent, and in effect justifies the complaint of the miner toward the policy of the forestry bureau. Taking up the testimony in support of the charge that \$500 had not been expended on each, the commissioner said:

"The mineral examiners for the forestry service admitted that they had no particular knowledge of the mining conditions in the Coeur d'Alene district, that they had not made examination of the surrounding properties, and that they had no specific knowledge of the cost of labor in the district. Consequently, for the work done on the claims protested for want of sufficient patent expenditure, the government experts gave extremely low figures." On the question of mineral discovery, the commissioner is equally pointed and severe. After analyzing the testimony as applied to each individual claim, he says:

"It is thus made clear why the government experts were unable to find any mineral indications on most of the claims, while the witnesses for the defense testified that they found some indications on almost every claim. The former were not familiar with mineral showings in the Coeur d'Alenes, and their opinions were formed on what they saw on the individual claims. On the other hand, the witnesses for the defense examined these claims in the light of their knowledge of conditions on surrounding lands."

News by Mining Districts

By Special Correspondents in the Field

London Letter

Rio Tinto Dividend Startled Lombard Street—Why Kirkland Lake Deal?

By W. A. DOMAN

London, Oct. 13—Rather unexpectedly, the directors of the Rio Tinto have resumed dividend payments, and out of the estimated profits of the current year 10s. per share is to be paid on the ordinary shares. This is the first payment on the ordinary shares since April, 1920, when £1 per share was distributed, making £2 per share for the year 1919. The market was not prepared for this resumption of dividends, in consequence of the low price of copper and the keen competition in the pyrites market, while the official circular refers to the suicidal policy of the Spanish Government in continuing to impose heavy export taxes. This policy has caused a considerable reduction in the number of men employed, and consequently until these adverse influences can be removed or mitigated, the operations of the company cannot be expected to show such good results as they have often shown in the past. Work is now being carried on under normal conditions, and the efficiency of labor has increased.

In view of what is stated above, it is suggested in some quarters that the directors may possibly have determined upon the declaration of a dividend in consequence of its claim for £1,500,000 against the British Government in respect of cuprous pyrites supplied for making munitions during the war. Despite competition, the Rio Tinto is worked on such a scale that its operations are generally profitable.

The directors of the Kirkland Lake Proprietary cannot be said to have made a good case in regard to the proposal they have laid before the shareholders for the disposal of the company's interests to an important American mining group having large holdings in northern Ontario. It is pointed out by the critics that the circular really kills itself, for while the suggestion for sale is put forward, it is also remarked that developments have disclosed important orebodies, which, with others it is hoped to locate, may assure continuous and satisfactory dividends. The question, therefore, is why shareholders should be asked to hand over such a promising property to American interests.

I understand that an important deal is in contemplation between the Consolidated Mines Selection Co. and the Anglo-American Corporation of South Africa. Details are not available, and the officials of the company are reticent. Nothing will be known until next Thursday, but I think my forecast will prove fairly correct. The C. M. S. will sell its South African interests—Brakpan Mines, Springs Mines, West Springs, and Daggafontein Mines—to the Anglo-American for a certain number of

shares and a certain amount of cash. There will be no issue of shares to shareholders of either company. Last year the C.M.S. paid no dividend. If it has had the same good fortune as other South African finance companies—and there is little doubt on the matter—a dividend will be paid next year on account of the current year. The reason for the deal is not even hinted at, but it may be that as the Anglo-American Corporation is a South African company and is already interested in the mines mentioned, the control can better be carried locally.

Johannesburg Letter

Greatest Rush in History on Opening of New Diamond Diggings

By JOHN WATSON

Johannesburg, Sept. 19—On Sept. 15, 1,636 morgen of the farm Kaalplaats were proclaimed as alluvial diamond diggings. One Cape morgen equals 2.12 acres, and these diggings abut on the Vaal River, near Lindegue's Drift, a few hundred yards above the Rand Water Board's huge barrage, which is built across the river. C. M. Jack, mining commissioner for the Western Transvaal, read the proclamation, after having flagged off a line 700 yd. long; but the line of peggers extended to three times that length. The signal was given by dropping a flag at 11 a.m.; the peggers rushed off as one man.

The reading of the proclamation had started at 10:40 a. m. This is said to be the biggest rush, so far, in the Transvaal. About 1,800 licenses had been issued and seventeen policemen were present to keep order. Among the "runners" were several well-known athletes, including K. K. MacArthur, of marathon sports fame.

The value of the finds, up to date of proclamation, was said to total £13,600, the weight in carats being 1,450. This gives an average value of over £9 per carat. In the owner's reserve, Theodore Schmidt had found a 45½ carat Cape yellow stone, for which he refused a price of £15 per carat. However, of the 800 diggers working last month, 760 drew blanks. Among the large number of diggers working on the owner's reserve, the average finds per week have recently been worth £1,700 and the diggers' expenditure has amounted to £2,150.

General Smuts, the Premier, accompanied by Sir George Buchanan, London harbor expert; Sir William Hoy of the South African Railways, and party, last week examined Sordwana Bay, on the Zululand coast, paying a visit, later, to Kosi Bay. It is said on good authority that Sir George Buchanan considers Sordwana to be eminently suited for the formation of a new harbor. It is situated at the mouth of a river, has a bay, a natural breakwater, and a bluff and there is an inexhaustible

supply of fresh water in a lake close by. Later reports indicate that the Premier and party were even more favorably impressed by Kosi Bay and Lake.

The proposed Vaal River control for supplying water to the Rand was described by W. Ingham, the chief engineer of the Rand Water Board, on Sept. 13 to the members of the South African Association of Engineers. The lecture was illustrated by lantern slides. The depth of water held up at the barrage is 25 ft., and this will back up the Vaal River for a distance of nearly forty miles. It has been calculated that the operation will give 20,000,000 gal. per day of water to the Rand. The barrage consists of a series of large sluice gates made of mild steel. Each gate weighs about twenty-six tons and has a counterweight of about sixty tons. The total cost of the development will be £525,000. It is expected to be complete by April next.

BRITISH COLUMBIA

Consolidated M. & S. Co. Is Shipping Surplus Lead Bullion to Bunker Hill Smelter in Idaho

Smithers—J. F. Duthie, of Seattle, states that mining equipment, including a compressor and air drills, will be shipped to facilitate further development on the Aldrich, Henderson, and White Swan groups of silver-lead claims, Hudson Bay Mountain. He says further, that surveyors are now working on the mountain preparatory to the erection of an aerial tramway from the mine to the Smithers railway depot. One hundred tons of silver-lead ore is ready for shipment.

Stewart—Wier Brothers & Co., of New York, are reported to have undertaken the financing of work necessary in the development of the Daly-Alaska group.

A strike of high-grade ore is reported as having been made on the Alaska-Premier, samples of the ore giving returns of 4.48 oz. of gold and 26.9 oz. of silver.

A prospect shaft is being sunk on the Big Missouri. It now is down about 60 ft. in good ore. The intention is to sink for another 25 or 50 ft.

The Silver Bell group of eight claims has been bonded to E. J. Riebe and associates, of Seattle. This property is situated on the east side of the Portland Canal at an elevation of 3,000 or 3,500 ft. There are three strong and distinct leads, all of which have been developed to some extent. They show gold and silver.

Trail—The Consolidated Mining & Smeltings Co.'s plant is operating at capacity. The lead refinery has been unable to treat the product of the furnaces, and 75 tons of lead per day is being shipped to the Bunker Hill Smelter at Kellogg, Idaho, for refining. About 3,000 tons has been shipped.

Sandon—The number of men employed in the Slocan district has increased from approximately 50 last year to about 400 now on the payrolls of the district.

ONTARIO

High-grade Ore in Keeley Mine—Porcupine-Davidson Will Spend £100,000

Cobalt—A new high-grade oreshoot, stated to be one of the richest yet found in this vicinity, has been opened on the Woods vein at the 7th level, of the Keeley property. The vein measures a foot wide in places. September production was 83,000 oz.

McKinley's September production was 52,000 oz. Some high grade is being mined from the recent discovery. The vein is wide but patchy.

The O'Brien has concluded a deal for the purchase of the Bailey mill. The sale was made through the court for the benefit of the Bailey bondholders, and the price is understood to be about \$75,000. The O'Brien mill was burned a couple of months ago.

During September the Nipissing mined ore of an estimated net value of \$194,240, and shipped bullion and residues of an estimated net value of \$235,000. The low-grade mill treated 6,834 tons and the high-grade plant 201 tons.

Kirkland Lake—The Kirkland mines are obtaining sufficient power for pumping purposes but not enough for mining. The power company has decided to make a permanent work of replacing the burned sections of the transmission lines, which will take a longer time than was originally estimated for a temporary job. It is probable that power will not be turned on until the first of November.

Thirty-four feet of drifting on the new vein of the Tough Oakes, recently found on the 4th level, gives an average assay of \$44 across 60 in., according to an official announcement.

The recent offering of 250,000 shares of Continental Mines, Ltd., at \$5 per share, is said to have been oversubscribed.

Porcupine—A discovery of extremely rich ore is reported from the 7th level of the Dome. September production was \$423,000, and October production is being maintained at about this level.

Hollinger has declared the regular four-weekly dividend of 1 per cent, payable Nov. 4. At the 800 level the company has entered into Schumacher ground, which the Hollinger recently purchased.

At a recent meeting of the Porcupine-Davidson, held in London, the president announced that the sinking of the proposed 1,000-ft. shaft and the building of a 500-ton mill would be completed in eighteen months, at an estimated expenditure of £100,000. An agreement has been entered into whereby the money is loaned for two years at 5 per cent interest, and there is a definite arrangement between the vendor company and Mitchelson-Partners, Ltd., whereby English and Canadian interests in the mines become equal. Well-known engineers have questioned the accuracy of published statements of the ore reserves.

MEXICO

Durango

State Government Takes Friendly Attitude Toward Mining Enterprise

BY ALBERTO TERRONES

Mining in the State of Durango has been greatly handicapped by local financial depression. Although a large area has been denounced, the investment of capital has been practically nil during the last year. It is expected that in the event of recognition of the Obregon administration by the United States Government, the situation would greatly improve. The state government has granted every reasonable facility to people willing to undertake mining, and the same policy will be followed hereafter. As regards the 2 per cent state tax on ore extraction, the government has not taken fiscal measures that will interfere with mining operations. The government has also taken pains to overcome the difficulties encountered by the *Cía. de Dinamita y Explosivos*, so that the production of dynamite may not be suspended. Twenty-eight mills have been reported to officials in the State of Durango, with a value of 2,020,000 pesos.

L. V. Elder and Geo. D. Wolfe recently have examined the camp of Guacamaya, in southern Durango. This camp is two days' ride south of the city of Durango; the road can easily be adapted for automobiles and trucks at small expense. The camp is supposed to contain much low-grade ore, with facilities for mill and hydro-electric installations.

J. B. Devlin, from St. Louis, Mo., representing La Cruz-Providencia Mining Co., is making arrangements preparatory to starting operations. The company controls and owns the following mines, situated in the Pueblo Nuevo district: La Providencia, La Cruz, Ampliación de la Cruz, Huinacastle, La Cubierta, Bello Encanto, El Salvador, Sindicato de San Luis, San Patricio, and Anexas a San Patricio. Devlin is optimistic about the future.

The *Cía. Minera de Peñoles, S. A.*, has started work preparatory to developing its Guanaceví mines. The shafts are being retimbered in the Santa Cruz properties, and the same will be done in the Arianeña group. M. W. Hayward and E. F. Salisbury, of the exploration department of the company, have recently visited Guanaceví. Details of operation will depend on their reports.

Mexico City—The mints have received instructions to cease the coinage of silver. Merchants are complaining that the country is being flooded with silver, while the gold coin is hoarded. For the present only gold coins of larger denominations and copper coins for small change will be minted.

Hermosillo—A. L. Lewis, of this city, has applied to the mining agency for titles to the Catalina, a group of four silver-lead claims about one mile south of El Represo.

YUKON TERRITORY

Lower Grade Ore Is Accumulating at Mayo

Mayo—The Keno Hill property shipped 3,100 tons of high-grade ore to the Selby smelter at San Francisco during the summer. The experiment of transporting ore from the mine to river boats by tractor trucks, which carry from 25 to 30 tons a load, is proving satisfactory. Important strikes are reported from the Beaver country, about 50 miles from here. Not much was known about them yet, but there were indications that the whole district is richly mineralized, and several outfits had been taken in to continue work all winter. Next summer both the Keno Hill and Alaska Treadwell Co. will install reduction plants for the treatment of low-grade ore. At present only ore running from \$100 a ton up can be shipped, and great dumps of the lower grade have been accumulating. Many of the placer companies, which have not been operating since early in the war, are planning to resume work next year.

BURMA

Burma Mines Produced 360,768 Oz. of Silver in September

Namtu—The Burma Mines during the month of September milled 17,750 tons of ore in the concentrator, producing 9,145 tons of lead concentrate, and 11,246 tons of lead-bearing material was smelted in the blast furnaces, producing 4,004 tons of hard lead. The refinery products were: refined lead, 3,464 tons; refined silver, 360,768 oz.

ARIZONA

Bisbee—The Copper Queen branch of the Phelps Dodge Corporation has encountered a flow of 1,100 gal. of water per minute in the Calumet & Cochise shaft. This is adequate to assure all the water necessary for the operation of the new Copper Queen concentrator. When it was decided to undertake the development of Sacramento hill, and the construction of a concentrator to handle the low grade ores, it was realized that a much larger supply of water than had previously been developed would be necessary. The Calumet & Cochise property was purchased, and work begun on the 700 level, the shaft being sunk to 1,834 ft. Drifting was then begun from the 1,800 level in a south-easterly direction, and at a point approximately 500 ft. from the shaft water was encountered, but the volume was not sufficient to meet the needs of the concentrator. Further drifting was done in the same direction, and at a point approximately 1,000 ft. from the shaft on the Black Gap fault. After 900 ft. of drifting on the fault a big volume of water was encountered, which assured a supply sufficient to meet all needs.

The Calumet & Arizona Mining Co. is expected to increase its production for October as compared with that of September. The increase of wages has been effective in bringing new men to the district.

Dragoon—E. C. Fulghum, B. E. Gilbert, and A. A. Seabright are examining the Golden Rule mine, a lead-silver producer, with the object of putting it into immediate operation.

The Texas-Arizona mine, owned by Sidney Webb, of Mineral Wells, Tex., is being operated by E. E. Gilbert and Alex Mills under a lease. Miller & Son, who are operating the Keystone mine, are building a substantial adobe store building and a bunk house. The machinery for the new mill is on the ground and will be installed by J. R. Hubbard.

CALIFORNIA

U. S. Smelting & Refining Co. Patents Claims—Gold Near Mariposa

Randsburg—About \$14,000,000 worth of ore has been blocked out and developed in the California Rand mine at Randsburg since its discovery late in 1919, according to the annual report to stockholders, recently issued. Much of this has been shipped, but in addition to the shipments ore worth \$7,728,000 is blocked out to a vertical depth of only 513 ft. From the returns from this development the company has paid \$1,964,800 in dividends, and on Oct. 4 had a cash balance of \$383,127.

Adjoining the California Rand property on the east is the Coyote claim of the Randsburg Silver Mining Co., which has sunk a shaft 700 ft. and opened up and drifted on the same vein as the California Rand mine, blocking out ore to an estimated reserve of \$1,000,000. No ore has been shipped from this property, on account of threatened apex litigation with the California Rand Silver Co.

Kennett—The U. S. Smelting, Refining & Mining Co., owner of the Mammoth and other copper mines in the Kennett district, has obtained a patent for the Spread Eagle group and other mining claims in the Flat Creek mining district. These comprise the McKinley, Evening Star, Backbone, Storm King, Link, Red Queen, Wedge, Spread Eagle, Ridge, Tom Boy, Canon, Grey Eagle, Connecting Link, Extension, Jumbo, Copper King, Copper Queen, Great View, Good Hope, Summit, American Girl, Merrimac, and North Pole.

Visalia—A discovery of gold seven miles from Mariposa is reported by a Visalia rancher. Four partners in the enterprise have located ten claims, extending for a distance of 15,000 ft. The vein is said to be a part of the famous Mother Lode, at a point where mining operations ceased some years ago.

Grass Valley—The Empire and North Star mines are employing about 1,000 men and are operating at full capacity.

Jackson—Forty feet of the Argonaut shaft has been retimbered. The objective is the 2,570 level. The bulkhead on the 2,500 level has been removed, and water has been poured down the shaft for several days in an effort to extinguish the fire. The Kentucky mine is operating forty stamps.

IDAHO

Labor Situation Improves in the Coeur d'Alenes

Wallace—The advance in wages at all the mines of the Coeur d'Alene district, Idaho, which went into effect on Oct. 1, has had the effect of greatly relieving the labor shortage, particularly of miners. Men are coming in every day, and from present indications the supply will be equal to the demand by the middle of November. The approach of cold weather is also a contributing factor toward bringing about this result, for men are naturally more disposed to seek work underground in winter than in summer. Miners receive \$5 per day and shovelers \$4.50.

Kellogg—The new power house of the Bunker Hill & Sullivan company is of brick, 125 x 30 ft. It was built entirely by local workmen, the only contract being with Holley-Mason Hardware Co., of Spokane, which supplied the roof. Power is obtained from the Washington Water Power Co., 60,000 v. being received at the substation, where it is stepped down to 2,300 v. and sent on three wires to the power house for distribution to the motors. There are now in use 350 electric motors.

To be prepared in case of failure to receive power at the substation, the building is equipped with two generators driven by steam turbines capable of developing 2,000 hp., steam being supplied by six Heine water-tube boilers of 300 hp. each. This equipment cost \$180,000. Here also are two motor generators used to supply current for the mine trolley system. Overhead is a crane which can convey 50,000 lb. The basement contains all auxiliaries for steam turbines. Altogether it is a splendid plant—clean, spacious, and one of the finest in the West.

Clarks Fork—The Auxer Gold Mining Co. has resumed operations after damages to the mining machinery by forest fires a few weeks ago. The mine is on a fork of Lightning Creek 6 miles from here. Development will be confined to a crosscut tunnel which will cut the three veins of the property at depth. Engineers' estimates indicate an average value of \$18 per ton in strong consistent shear zones averaging 10 ft. in width.

Hope—The Hope Mining & Milling Co. has been reorganized as the Morning Star Mines. Under the reorganization plan three shares in the old company are to be substituted for one share in the new. Assessments will be levied to provide funds necessary for further development.

Bonnors Ferry—Construction of the 150-ton cyanide mill on the Cyanide Gold Mining Co.'s property is progressing; the mill structure is practically completed. The equipment will be largely fine-grinding machinery, the ore being ground in solution to 200 mesh.

WASHINGTON

George Wingfield and Associates Reopen Boundary Red Mountain Property

Bellingham—George Wingfield, of the Goldfield Consolidated Mines Co., and Joseph Pheby, of San Francisco, control the Boundary Red Mountain mine, situated in the Mount Baker district. Development during the war was discontinued on account of high costs. The mine is equipped with a mill of 60 tons' daily capacity, operated by water power developed on Silesia creek about 1½ miles from the mill. The mine is developed by two crosscut tunnels to the vein, the lower tunnel encountering the lode at 500 ft. depth, with drifting on both levels aggregating 3,000 ft. The vein is 3 ft. in width, and is said to return assays of 1.13 oz. gold. In 1917 10,000 tons was mined, yielding a gross value of \$148,600.

Valley—The Admiral Mining Co. has started development operations at its property near here with a small force. The lower crosscut tunnel will be extended to a point below the ore developed in the upper workings.

Chewelah—The Double Eagle mine has recently let a contract to extend the 1,200-ft. crosscut to the vein, which will greatly facilitate the extraction of ore above the level.

Boundary—Owners of the Melrose mine, on Bush Creek, 3½ miles north of here, made a shipment some time ago, and the returns were so gratifying that a three-drill steam compressor has been installed. Regular shipments will be made of ore running high in silver, according to P. H. Graham.

NEVADA

Tonopah Divide Produced 1,600 Tons of \$30 Ore in September

Royston—The shipment recently made by the Canadian Leasing Co., present owners of the original Betts lease, amounted to 26 tons, of an average value of \$197 per ton, and a gross value of \$5,122.

Divide—Production of the Tonopah Divide mine for September was 1,603 tons, averaging in value \$29.79 per ton, and having a gross value of \$47,745. This is much lower in value than the production for August, when the output was \$71,917 from 1,645 tons. It has been officially stated that shipments will be kept at about \$25 per ton. The mine is in splendid condition, and there is 1,500 tons of \$75 ore broken in the stopes. The crosscut on the 1,400 level is out 500 ft. from the shaft, but no vein has been encountered.

Pioche—The Godbe interests remain in control of the Prince Consolidated Mining Co. as a result of the election of officers held at the recent annual meeting. Machinery has been ordered to hasten unwatering and the development of the property at depth. Four important objectives will be sought: the beds found to the east of the shaft, fissures number one and two, the faulted

sections of the upper bedded deposits to the west of the shaft, and the No. 3 or new fissure discovered just before the water drove the miners from the headings.

Leasing has increased in the Pioche district. Among the properties recently leased is the Mendha mine, in the Highland district, from which steady shipments have been going forward for the past two years. The ore carries \$8 in gold, 8 oz. in silver, and 10 per cent lead. The Bristol mines continues to send out a large tonnage, the ore recently handled being a higher-grade product.

Shipments from the Pioche district included the usual tonnage of tailings from Bullionville and Dry Valley, ore from the Bristol Silver mine, a small lot of ore from the Geer mine, at Irish Mountain, and a car from the Lyndon mine, at Comet.

NEW MEXICO

Chino Copper Increases Output—Anita Company Cuts Copper Vein

Hurley—Production at the Chino Copper Co. mill has increased to about 350 tons of concentrate daily. This is shipped to the El Paso smelter under contract.

Lordsburg—The Calumet & Arizona Mining Co. has purchased the Old Town claim, adjoining the 85 mine property, from the Johnnie Brown estate.

Smelter returns on the last shipments of Bonney mine ores to the Copper Queen smelter at Douglas, Ariz., ran 0.46 oz. gold, 6.08 oz. silver, and 5.27 per cent copper. This vein in No. 1 shaft is 3½ ft. wide.

The Anita Copper Co. has cut the big vein in the 300 level from the old shaft on the west side of the property. This level is 700 ft. long and shows a vein, where struck, about 6 ft. wide. A drift will be run on the vein and raises made at No. 1 and No. 3 shafts. A carload of concentrates carrying lead, silver, and copper was shipped to the El Paso smelter last week.

Mogollon—La Corona de Oro Mining Co. has been organized under Arizona laws, to take over the Gold Crown No. 1 and No. 2 claims from E. G. Foreman, of Cripple Creek, Colo., and associates. L. G. Gould, of El Paso, is president of the company. A tunnel now in 150 ft. will be driven to cut the vein, giving about 400 ft. of backs. The vein, as exposed in a shaft from the top of the mountain, is from a few inches to 3 ft. in width, with values said to run up to \$30 gold per ton, the ore being a free milling quartz. A Gibson mill will be erected on Little Dry Creek.

Santa Fe—The Gypsum products Co., of Alomogordo, has filed incorporation papers. The capital stock is given as \$100,000 with \$15,000 paid in. The incorporators are J. G. Barrett, Alomogordo; C. L. Beatly, Long Beach, Calif., and J. W. Fetz. It is this company's intention to work the gypsum deposits west of Alomogordo known as the "white sands."

UTAH

Iron Blossom Pays Dividend — Lambourne Properties Are Listed on Salt Lake Exchange

Salt Lake City—The Columbia Steel Corporation, according to one of its officials, has secured title (with the exception of railroad rights across the ground) to 600 acres of land lying north of the town of Springville, near Utah Lake. The tract is crossed by four railroad lines—the Orem Electric, Denver & Rio Grande Western, Los Angeles & Salt Lake, and Utah Railroad. The Columbia Steel Corporation, as has already been stated in these columns, is seeking to exploit iron and coal deposits in southern Utah. California and Utah men are interested.

Eureka—Tintic shipments for the week ended Oct. 14 amounted to 157 cars, compared with 160 the week preceding. Shippers were: Chief Consolidated, 37 cars; Tintic Standard, 33; Grand Central, 22; Dragon Consolidated, 12; Iron Blossom, 11; Colorado, 11; Eagle & Blue Bell, 9; Victoria, 8; Swansea, 3; Empire Mine 3; Centennial-Eureka, 2; Bullion Beck, 1; Eureka Hill, 1; Joe Bocoers, 1; Tintic Drain Tunnel, 1; American Star, 1; Gemini, 1. There were also shipped by the Chief Consolidated, 12 cars of limestone and 17 cars of road material.

The Iron Blossom pays its third quarterly dividend for 1922, amounting to \$25,000, at the rate of 2½c. a share, on Oct. 25. This brings the total by the company to \$3,375,000. Production has kept up, in spite of difficulties from the caving in of old stopes, and there is said to be a good surplus in the treasury. More ore has been shipped lately directly to the smelters, and less to the Tintic Milling Co., an indication that the grade is improving. In July and August production was at the rate of 60 cars a month, whereas during September and October it has been averaging 45 cars.

Park City—The stocks of two Park City corporations — the Park City Mining and Smelting, and the Park Utah Mining—have been listed on the Salt Lake Stock Exchange. The Park City Mining & Smelting Co., whose property is the same as that formerly owned by the Judge Mining & Smelting Co., the Daly West Mining Co., and the West Ontario Mining Co., is capitalized at \$7,500,000, divided into 1,500,000 shares of non-assessable stock, of which 876,000 have been issued. There are 8,000 stockholders; there is no indebtedness, and the cash balance amounts to \$300,000. G. W. Lambourne is president of the company.

The Park-Utah — capitalized at \$1,250,000 in \$1 shares—has 400 stockholders, with about \$1,000,000 shares issued. There is said to be nearly \$350,000 in the treasury. Since the beginning of shipments by this new producer, there has been shipped 791 cars of ore of a market value of more than \$40 per ton.

COLORADO

Cresson Pays Dividend—Railroad Shop Strike Threatens To Stop Mining

Cripple Creek—Accompanying the checks for the payment of the third quarterly dividend of 10c. per share by the Cresson Consolidated Gold Mining Co. was the report to the stockholders showing a net profit for the third quarter of approximately \$113,000. Equipment is now being installed which will make possible the development of not less than 1,000 ft. below the present workings. Deeper work is warranted by the present showing.

Leadville—Improvements are being made at the local plant of the American Smelting & Refining Co. R. B. Rathbun, of Salt Lake City, an official of the company, is in the city supervising the installation of a Cottrell treater at the A. V. plant.

Cortellini & Co. are installing additional equipment on the Blaine shaft to handle increasing output of ore, which is being shipped to the Canon City plant of the Empire Zinc Co. for treatment.

Operators of the Belgian mine, in Stray Horse Gulch, on Oct. 19 made the first shipment from the mine for twenty-five years. The property was recently taken over by local men.

Owing to car shortage, the September production of coal in Colorado decreased 105,389 tons, compared with the previous month, and was 22,000 tons less than for the corresponding month in 1921. Production since Jan. 1 was given as 6,916,131 tons, an excess of 307,105 tons over the same period last year.

Ouray—It is reported that negotiations have been completed for the taking over of the plant of the Ouray Smelting & Refining Co. by Boston interests represented by Charles E. Holton. It is said that extensive improvements are to be made to the plant, which will operate as a custom smelter in addition to treating of ores from the company's mine in the vicinity of Red Mountain.

Durango—A voluntary advance of 25c. a day in wages to all employees of the local plant, except the office force, has been announced by the American Smelting & Refining Co., effective Oct. 1. The minimum wage is now \$2.60 for an eight-hour day.

Lack of motive power to move ore on the narrow-gage lines of the Denver & Rio Grande road is resulting in decreased production, and unless relief is afforded soon some of the mines will be forced to close down. Hundreds of cars of ore are on the tracks awaiting transportation to the smelters, but the railroad company is unable to move them because of the lack of engines. Strike conditions resulted in increased number of disabled engines and a lack of machinists for repair work threatens an almost complete tie-up of most of the mining operations in several of the larger districts.

JOPLIN-MIAMI DISTRICT

Activity Near Crestline

Joplin—O. W. Sparks and associates have renewed operations at their property in the Crestline (Kan.) section. They have a shaft down to ore, and will unwater and develop. The location is just to the northeast of the Interstate Zinc-Lead Corporation's new property, where a double compartment shaft, large enough to accommodate skips, is being sunk.

The Bernard Mining Co. has completed the erection of a 150-ton concentrator on the Brooks land, about five miles northwest of Joplin. The company has 200 acres in this tract, and recently obtained a lease on an additional eighty-acre tract to the north, which it will drill out. The new mill uses oil engines for power. Vincent B. Bernard, of Joplin, is manager.

The Underwriters' Land Co. has taken a lease on the Johnston land, about one mile southwest of Joplin, and has placed a drill upon it. The land has produced considerable ore in the past, but mostly at a shallow level.

The Admiralty Zinc Co. has leased 245 acres of land about one mile south of its holdings near Douthat, Okla., and will place drills at work immediately. M. B. Lawrence, of Joplin, is manager.

MICHIGAN

Reduction of Mine Costs Is Vitally Necessary—Sundry Measures Taken

Houghton—Special attention to ways and means of reducing costs was never more important than during the present period of labor shortage. Efficiency has increased and improvements in mining, milling, and smelting practice are having their effect in relatively larger output. Many more men could be used, particularly by mines independent of the Calumet & Hecla group, but in future top production will be reached with fewer men than were employed in the best copper years in the past. It is doubted by mine managers whether mine labor ever will be so plentiful as it once was, if present restrictions on immigration remain in force. The mines depended to a large extent on immigrants for trammers and other underground laborers, and this source has been practically shut off. Wages now paid compare favorably with pre-war schedules. More liberal bonuses enable a miner or trammer to earn as much as before the war, and from this time on it is believed fewer men will leave the district.

Particular care in the selection of rock to be mined is now the rule in all Lake mines, and generally there has been an improvement in yield per ton of rock hoisted. Centralized power, hoisting, shop work, and office work, as well as a more extensive use of electric pumps and mechanical loaders and scrapers in stopes and levels, have all contributed to a lowering of costs. In the conglomerate department of Calumet & Hecla the construction of a haulage level at a depth of 8,100 ft.

will solve the problem of deep mining in these shafts. It will permit the mining of the lode at depth, and eventually all hoisting will be done in one shaft, permitting the abandonment of the entire series of conglomerate shafts, with their separate hoisting equipment.

Regrinding installations in the various stamp mills of the district have reduced copper losses in the tailings to an absolute minimum, which, for amygdaloid rock, is approximately 4½ lb. per ton. In the smelters, automatic handling devices have reduced costs, and in the Michigan plant the pulverizing of coal for the furnaces has reduced fuel bills 33½ per cent.

MINNESOTA

Several Companies Have Completed Shipments for the Season

Biwabik—The Biwabik mine, operated by the Tod-Stambaugh Co., has completed its ore program for this season, with a total shipment of 300,000 tons. Stripping operation is now being carried on and will continue during the winter.

Kinney—The Republic Iron & Steel Co. has completed its ore shipments at the Kinney mine for 1922. This property is worked by open-pit methods only, and forwarded approximately 300,000 tons for this shipping season.

Hibbing—The Utica mine, a property of the Pickands-Mather Co., has practically finished its underground shipments for this year, amounting to 200,000 tons. This property is one of the largest underground producers on the range, and the present plans call for full operations this winter.

The Mesaba-Cliffs Iron Mining Co. has announced the reopening of the underground workings at the Boeing mine. The property has been closed since April, 1921, and only a small initial tonnage had been mined when the underground work was suspended. Ore operations will start on completion of work incidental to the reopening of the property, which should take place about Nov. 15. Both stripping and ore operations continue in the open pit.

Chisholm—Ore shipments at the Dunwoody mine, operated by the Orwell Iron Co., are still going forward, with 600,000 tons as the goal for total shipments of this season. Preparations are now being made for an extensive stripping operation this winter.

Gilbert—The shaft at the Hobart mine, a property of the Hanna Ore Mining Co., is to be sunk an additional 70 ft. and a new tram level is to be developed for the mining of the ore above this level. The Hobart stockpile has been shipped, and it is anticipated that the property will be worked to full capacity during the winter months.

Nashwauk—To meet the increased demands on its pumping capacity due to the construction of a new unit to the Hawkins mine concentrator, the Wisconsin Steel Co. is installing a centrifugal pump with a capacity of 3,000 gal. per minute as an addition to the present station at O'Brien Lake.

THE MARKET REPORT

Daily Prices of Metals

Oct.	Copper, N. Y., net refinery* Electrolytic	Tin		Lead		Zinc
		99 Per Cent	Straits	N. Y.	St. L.	St. L.
19	13.50@13.625	34.25	34.875	6.50@6.60	6.30	6.85
20	13.50@13.625	34.125	35.00	6.50@6.65	6.325	6.85
21	13.50@13.625	34.125	35.00	6.50@6.65	6.35	6.85@6.90
23	13.50@13.625	34.375	35.125	6.50@6.60	6.375	6.95@6.975
24	13.50@13.625	34.50	35.375	6.50@6.60	6.40	6.975@7.025
25	13.50@13.625	35.00	35.875	6.50@6.60	6.40	7.00@7.05

*These prices correspond to the following quotations for copper delivered: Oct 19th to 25th inc., 13.75@13.875c.

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. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Federal Bureau in Washington which are interested in the mining industries.

London

Oct.	Copper			Tin		Lead		Zinc	
	Standard	Electrolytic	Spot	Spot	3M	Spot	3M	Spot	3M
	Spot								
19	62	62½	70	172½	173½	25	24½	35½	34½
20	61½	62½	70	171½	172½	24½	24½	35½	34½
23	62½	63½	70½	173½	174½	25	24½	35½	34½
24	63	63½	70½	174½	175½	26½	25½	36½	34½
25	62½	63½	70½	176½	177½	26½	25½	36½	35½

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

Silver and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver			Oct.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
19	4.47½	99½	67½	33½	23	4.45½	99½	67½	33½
20	4.46½	99½	66½	33½	24	4.44½	99½	67½	34½
21	4.46½	90½	66½	33½	25	4.43½	99½	67½	34½

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

Metal Markets

New York, Oct. 25, 1922

The metal markets have been generally quiet the last week. Transportation difficulties continue to trouble producers and consumers alike, and it may be some weeks before the various embargoes are lifted. The undertone in practically all of the metals continues strong, with price tendencies upward.

Copper

The market is quotably unchanged from the prices of last Wednesday. On Thursday, Friday, and Saturday the 13.75c. delivered price became more general, and at least three or four producers were willing to book business on that basis. Monday there was less

a desire to sell at that level, and today, although business has been done at 13.75c. delivered, several of those who have been selling at that price have now withdrawn from the market. Practically all producers have been willing to sell at 13¼c. throughout the week, but have done only scattering business at that level. Some of those who were willing to sell at low prices have done a satisfactory business, but the total sales have probably not been more than half the average weekly business of August and September. Consumers report their mills operating to as near capacity as the labor supply and transportation conditions will allow. As stocks of copper are down to normal, producers and dealers alike are inclined

to be bullish over the market prospects for the next few months.

Foreign sales were better during the last week than for several weeks. Prices were not quite so satisfactory, however, owing to competition between independent producers and the Copper Export Association. Despite the fall in the mark, Germany is still taking some copper.

Forward deliveries have commanded the same prices as have been asked for spot. Some business has been placed for the first quarter of 1923, but it is not yet large.

Lead

The official contract price of the American Smelting & Refining Co. continues at 6.50c., New York.

The lead market in New York has been unusually quiet during the week, with inquiries lacking as well as orders. Producers have been glad of the respite, however, as it is giving them a chance to catch up somewhat with their order books. The lull in demand has had no depressing influence in prices, though there is somewhat less of evidence of paying fancy prices for spot supplies. In St. Louis, the market has been more active, with sales of fair tonnages almost every day, at gradually advancing prices. Corroding lead commands the customary differential of 10c. per 100 lb.

The advance in the London market is of interest. A pronounced shortage of metal for spot delivery is indicated by the unusual premium. However, the forward position has also reached the point where all Mexican lead will probably be shipped abroad. Parity today is about 5.08c., and adding to this 2.12c. for duty into this country would bring the prices to 7.20c., which, of course, cannot be realized. The freight is substantially the same either way.

Zinc

The market advanced during the week, crossing the 7c. level, and is strong today. The greatest advance was recorded on Monday. Producers report excellent business, and one or two of them who have hesitated up to now in selling their output have disposed of large tonnages. Although production is expected to be stimulated by the increase in price, a shortage of labor and unsatisfactory transportation conditions are likely to hold it in check. Prompt metal is scarce and commands a slight premium, 0.025c. over zinc for forward delivery. Consumers frequently have been requesting immediate shipment, indicative that only small stocks are in their possession. There is a possibility of zinc being shipped abroad in the future, but the European prices are still too low to permit profitable export business. Zinc is as strong abroad as in

this country. The price of high-grade zinc was advanced to 8c. on Monday, and a gratifying business is reported on that basis, with the usual 30 point freight allowance per 100 lb.

Tin

The advance of last week has continued, and prices seem firm at current levels. Consumers here are taking little interest in the market, evidently thinking it a speculative movement which will later have a reaction. Good tonnages of tin have been sold here in the last few days, but the metal has been bought for the account of London houses. Forward tin has commanded approximately the same price as spot.

Arrivals of tin, in long tons: Oct. 18th, Java, 325; Straits, 25; 19th, Straits, 50; 20th, London, 40; Liverpool, 100; 23d, London, 100; China, 150; Straits, 1,075; Liverpool, 60. Total to date this month, 5,541.

Gold

Gold in London: Oct. 19th, 92s.; 20th, 92s. 3d.; 23d, 92s. 5d.; 24th, 92s. 7d.; 25th, 92s. 9d.

Foreign Exchange

Foreign exchanges continued unsettled during the week. German marks reached a new low on receipt of the German Chancellor's suggestion that Germany go into bankruptcy. On Tuesday, Oct. 24, francs were 7.10c.; lire, 4.06c.; marks, 0.024c.; and Canadian dollars, $\frac{1}{2}$ per cent premium.

Silver

The silver market continued to show a downward tendency until the 21st, owing principally to the closing of the Canton mint. The consumption of this mint for coinage purposes for the current year from Jan. 1 to Oct. 21 was 30,000,000 oz. of foreign silver. A temporary inquiry for San Francisco delivery arose on the 23d, which helped to steady the market.

Mexican Dollars—Oct. 19th, 51½; 20th, 51; 21st, 51; 23d, 51½; 24th, 51½; 25th, 51½c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—Importers are not anxious sellers, preferring to wait for better prices. General market for 99 per cent grade, about 20@21c. per lb.

Antimony—Chinese and Japanese brands, 6½@7c.; W. C. C., 7@7½c. Cookson's "C" grade, spot, 9c.

Bismuth—\$2.35@2.45 per lb.

Cadmium—Quiet at \$1.15 per lb.

Iridium—\$275@300 per oz. Nominal.

Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Outside market, 32@34c. per lb.

Osmium—Pure, \$60@70 per oz. troy, in Los Angeles. Strong.

Palladium—\$55 per oz.

Platinum—\$108 per oz. Easier.

Quicksilver—\$73 per 75-lb. flask. Market firm. San Francisco wires \$70.80.

Selenium—\$1.80@1.90 per lb.

Tellurium—\$1.75 per lb.

Tungsten—Powder, 75c.@1.05 per lb.

The prices of Cobalt, Magnesium, Molybdenum, Monel Metal, Osmium, Rhodium, and Thallium are unchanged from prices given Oct. 7.

Metallic Ores

Chrome Ore—Indian chrome ore, \$18 per ton, c.i.f. Atlantic ports. Rhodesian and New Caledonian, \$23 and \$25 per ton. Market quiet.

Iron Ore—Lake Superior ores, per long ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, \$5.95; Mesabi bessemer, 55 per cent iron, \$5.70; Old Range non-bessemer, 51½ per cent iron, \$5.20; Mesabi non-bessemer, 51½ per cent iron, \$5.05.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, \$5 per long ton; old bed concentrates, 63 per cent, \$5.25; Harmony, cobbed, 63 per cent, \$5.25; new bed low phosphorus, 65 per cent, \$7.50.

Manganese Ore—30c. per long ton unit, seaport, plus duty; equivalent to about 45c. Chemical ore, \$70@75 per gross ton.

Molybdenum Ore—55@60c. per lb. of MoS₂ for 85 per cent MoS₂ concentrates, plus duty; equivalent to 80@85c. per lb.

Tungsten Ore—Chinese ore, \$7.50@8 per long ton unit of WO₃.

Tantalum, Titanium, Uranium, Vanadium, and Zircon ore are unchanged from the quotations published Oct. 7.

Zinc and Lead Ore Markets

Joplin, Mo., Oct. 21—Zinc blende, per ton, high, \$43; basis 60 per cent zinc, premium, \$42@43; Prime Western, \$40@41; fines and slimes, \$39@35; average settling price, all grades of blende, \$39. Calamine, basis 40 per cent zinc, \$22.

Lead, high, \$86.80; basis 80 per cent lead, \$87.50; average settling price, all grades of lead, \$83.91 per ton.

Shipments for the week: Blende, 5,816; calamine, 43; lead, 1,404 tons. Value, all ore the week, \$344,030.

Purchases were again large, but were 1,160 tons less than last week. Demand was such that sellers obtained an advance of \$1 per ton on almost all grades of zinc blende, and lead quotations were advanced \$2.50, to \$87.50 per ton.

The shipment fell 1,320 tons below the previous week, and was the lowest since last February.

Platteville, Wis., Oct. 21—Blende, basis 60 per cent zinc, \$45.50 per ton. Lead, basis 80 per cent lead, \$90 per ton. Shipments for the week: Blende, 789; lead ore, none. Shipments for the year: Blende, 16,499 tons; lead, 1,324 tons. Shipped during week to separating plants, 1,206 tons blende.

Non-Metallic Minerals

Borax—5½@6c. per lb.

Asbestos, Barytes, Bauxite, Chalk, China Clay, Emery, Feldspar, Fluorspar, Fuller's Earth, Graphite, Gypsum, Limestone, Magnesite, Mica, Monazite,

Phosphate, Pumice, Pyrites, Silica, Sulphur, and Tale are unchanged from the prices published Oct. 7.

Mineral Products

Arsenious Oxide (white arsenic)—firm at 10½@11c. per lb.

Copper Sulphate—Large crystals, 5.80c. per lb.; small, 5.70c.

Sodium Nitrate—\$2.25@2.65 per 100 lb., ex vessel Atlantic ports.

Potassium Sulphate and Sodium Sulphate are unchanged from quotations of Oct. 7.

Ferro-Alloys

Ferromanganese—Domestic, 78@82 per cent, \$69@75 per gross ton, f.o.b., furnace. Spiegeleisen, 19@21 per cent, \$39, f.o.b. furnace; 16@19 per cent, \$38.

Ferrotungsten—Domestic, 70@80 per cent W, 75c.@1 per lb. of contained W, f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferro-uranium, and Ferrovandium are unchanged from the prices published Oct. 7.

Metal Products

Zinc Sheets—\$8.75 per 100 lb., f.o.b. works.

Copper Sheets, Lead Sheets, Nickel Silver, and Yellow Metal are unchanged from the prices published Oct. 7.

Refractories

Bauxite brick—\$45@50 per net ton, f.o.b. shipping point.

Chrome Brick, Chrome Cement, Magnesite Brick, Magnesite Cement, Silica Brick and Zirkite are unchanged from the prices published Oct. 7.

The Iron Trade

Pittsburgh, Oct. 24, 1922

The past fortnight has been the dull-est in the finished steel markets since the first of the year. Steel prices, for extended delivery, are unchanged and are firmly maintained. The National Tube Co., under date of Oct. 19, advanced all welded tubular products 2 points, or about \$4 a net ton, independents of course, immediately following. The basing discount on merchant steel pipe changes from 68 to 66 per cent. Premiums for early deliveries continue to diminish.

Production of steel ingots continues at say 36,000,000 or 37,000,000 tons a year, or at about 70 per cent of capacity. There are car shortages still, but steel is no longer accumulating at mill to any extent.

Connellsville Coke—Furnace coke has declined farther, being freely offered for several days at \$8, against \$12 steadily maintained until hardly more than a fortnight ago. Production continues to increase, and consumers are now disposed to hold off as much as possible.

Pig Iron—With increasing production, providing more deliveries on old contracts, and with coke declining, pig iron is weak, and considerably lower prices are expected. Bessemer remains at \$33 and basic at \$30, Valley. Foundry iron has sold off \$2 to \$30, Valley.

The German Metal Market at the Threshold of Winter

Outlook for Resumption of Normal Industrial Activities Sombre—Exchange Fluctuations Handicap Trade

SPECIAL FOREIGN CORRESPONDENCE

Charlottenburg, Oct. 10.—Since the end of July, fuel, transport, wages, and export duties have caused insurmountable difficulties for business operations, and jobbers in metals and speculators of all sorts are drawing profits from the middle. The need of supplies of household coal for the coming winter for the population, the operation of the Upper Silesian coal deposits, and the heavy reparation deliveries of fuel have created a shortage of the "bread of industry" and are compelling smelters, rolling mills and manufacturers to import coal from the United Kingdom. Unluckily, money shortage and credit stringency stand in the way of securing adequate quantities of foreign coal in the same serious degree as the debasement in the mark value is diminishing its purchasing power and, on the other hand, is increasing wage rates and costs in general. Metal manufacturers are looking ahead to extensive unemployment all over the country in the winter that is before us. They are setting their hopes in the agreements recently reached between Mr. Stinnes and M. de Lubersac, and similar conventions between German-French industrial groups, by which, it is expected here, some part of reparation coal may be released for reconstruction purposes. If so, refineries may be able to turn out copper sheet, lead tubes, or galvanized sheet from scrap, which exists in great quantities in France, the refining capacity of which is relatively small. Russia also has begun to deliver old metal to Germany by the intermediary of the Deutsch-Russische Metallverwerkungsgesellschaft (at Charlottenburg), which is handling this material as a commissioner of the Metallotorg of Moscow.

SHORTAGE OF ZINC SERIOUS

Great concern is felt about the future of Germany's galvanizing industry. According to an expert computation there is at present a visible supply of zinc of former Upper Silesian origin to the amount of only about 7,000 metric tons within the boundaries of the country. This figure is exactly half of that of the same period of 1921. The supply is suffering heavy depletion because of the activity of sheet makers in the provinces of Rhineland and Westfalia.

The present zinc supply is too small for an industrial country like Germany. The quantities afforded by Norway are none too great. Therefore the question of securing sufficient supplies of galvanized sheets for reconstruction purposes is yet in abeyance. Contrary to some sanguine opinions, the experts are sceptical about alleged big French supplies of old zinc. For some time certain producers were trying to renew the former European zinc convention, but in view of fact that the ever-increasing Belgian output is finding a ready outlet in France in a rolled form, this effort is being abandoned. As for the zinc market in Germany, people here find it difficult to obtain ruling quotations, for the representatives of the Zinc Syndicate are declining to quote responsible prices, limiting themselves to converting the London quotations into marks. Thus the hope to maintain an independent German market, at least for zinc metal, has faded away.

GERMAN PEOPLE BUYING SILVER

The silver quotations of Berlin and Hamburg often lie above the London level, owing to the fact that German people invest their cash in this metal whenever foreign exchanges are unattainable in the open market for future delivery. In times like the present, when importers are in need of foreign currency in order to pay loans, and purchase cotton and other commodities, the supply of

foreign commercial bills or money is unusually small, because of the overwhelming demand for it. Therefore people have accustomed themselves to buying silver instead of currency, the more so as silver can be acquired at the exchanges on speculative terms and for future delivery. By the help of the Metall-Liquidationskasse A. G., established by the big banking firms in Berlin, forward dealing in silver is now going on, as has long been the case at Hamburg, and at the Berlin Exchange also. For this purpose new rules and regulations have been set up here, providing a contract unit of 50 kg. of pure metal. Bar silver of between 900 and 1,000 fine assay constitutes a good delivery. The rough weight of the ingots is not to exceed 185 kg. A margin of 3/1,000 assay is not regarded as a deficiency. The certificates of the laboratories of A. G. fur Bergbau, Blei-und Zinkfabrikation zu Stolberg und Westfalen (at Aachen), of the Mansfeld A. G. fur Bergbau und Huttenbetrieb (at Eisleben), and of the state-owned, Germanschaftshuttenamt (at Oker)—that is to say of the sales of German silver producers—are accepted by the advisory board of the exchange.

RESUMPTION OF COPPER BUYING EXPECTED EARLY IN 1923

I learn on good authority that forward business in copper is to begin here in the month of January, 1923. At present this line of business is handicapped by the fact that even the big cable makers are demanding long credits. The Dutch revolving credit accommodation to the amount of 140,000,000 guilders, which is yet partly at the disposal of the trading community of this country, has been largely drawn upon by the metal manufacturers for the purpose of buying copper in America and nickel in Canada. At present the granted credit is approaching exhaustion. As for inland credit accommodation, interest rates of 50 per cent or more are simply prohibitive to business. Copper business is therefore bound to diminish fast in the approaching winter. Innumerable contrivances and inventions of engineers are expected to supersede copper, tin, and nickel in many important alloys by cheaper metals, and it is emphasized that the three principal German babbitt types have already largely contributed to the saving of German money. The wider use of aluminum for electrical current is at present subject to earnest study of German metallurgists. There exist already quite a number of scientific research institutions, strongly favored by captains of industry, of which I may mention the Institut fur Metallforschung near Berlin, and the Gesellschaft fur Metallkunde (a union of engineers).

Mining Dividends for October

The following dividends were paid by mining and metallurgical companies during October, 1922:

Companies in the United States	Situation	Per Share	Total
American Smelters Sec. pfd. "A".....	U. S.	\$1.50Q	\$146,071
American Smelters Sec. pfd. "B".....	U. S.	1.25Q	39,855
Cresson Consolidated Gold.....	Colo.	0.10Q	122,000
Eagle-Picher Lead pfd.....	Mo., Okla.	1.50Q	15,000
Homestake Mining, g.....	S. D.	0.25M	62,790
Park Utah Mining, s.l.....	Utah	0.15	150,000
Phelps Dodge Corporation, c.....	U. S. and Mex.	1.00Q	450,000
Tonopah Extension, s.g.....	Nev.	0.05Q	64,636
Tonopah Mining, s.g.....	Nev.	0.075XX	75,000
United Eastern, g.....	Ariz.	0.15Q	204,450
U. S. Smelting, Ref. & Mining, pfd. s.l.	U. S. and Mex.	0.875Q	425,556
Companies in Other Countries			
Asbestos Corporation.....	Que.	1.50Q	45,000
Asbestos Corporation pfd.....	Que.	1.75Q	70,000
Dolores Esperanza, g.s.....	Chi., Son	0.05Q	43,241
Dome Mines, g.....	Ont.	0.50Q	238,333
Hollinger Consolidated Gold.....	Ont.	0.05—4 wks	246,000
Kerr Lake, s.....	Ont.	0.125Q	75,000
N. Y. & Honduras Rosario, g.s.....	Hond.	0.25Q	50,000
Nipissing, s.....	Ont.	0.30QX	360,000
Wright-Hargreaves, g.....	Ont.	0.05Q	137,500

Q, quarterly; M, monthly; X, includes 15c. extra; XX, includes 2½c. extra; g, gold; s, silver; l, lead; c, copper.

The disbursements this month show little change from those made three months ago. Park Utah enters the dividend list, but Tonopah Be'mont Development does not report the usual distribution due this month. Nipissing and Wright-Hargreaves, in Canada, doubled the usual dividend.

COMPANY REPORTS

American Smelting & Refining Co.

A consolidated report of operations of the American Smelting & Refining Co. and the American Smelters Securities Co. for the first six months of 1922 shows a balance of income of \$1,825,923.38 against a deficit of \$1,101,831.49 for the corresponding period of 1921, when conditions were unsatisfactory.

A comparative income account follows:

	Six Months Ended June 30, 1922	Six Months Ended June 30, 1921
Net earnings of smelting and refining plants.....	\$5,216,128.17	\$2,494,892.52
Net earnings from mining properties.....	877,408.80	(a) 77,131.61
Total net earnings of operating properties.....	\$6,093,536.97	\$2,417,760.91
Other income, net:		
Interest, rents, dividends, commissions.....	167,315.75	30,805.25
Net earnings.....	\$6,260,852.72	\$2,448,566.16
Deduct:		
General and administrative expenses.....	504,200.64	461,681.01
Research and examination expenses.....	26,495.77	64,094.14
Corporate taxes.....	286,222.41	3,775.50
Total to deduct.....	\$816,918.82	\$529,550.65
Net income from current operations.....	\$5,443,933.90	\$1,919,015.51
Less:		
Interest on Americal Smelting & Refining 5 per cent first-mortgage bonds.....	\$865,925.74	\$791,201.14
Interest on Rosita Coal & Coke 6 per cent collateral trust bonds.....	21,174.67	29,275.78
Miscellaneous adjustments.....	505,085.22	96,700.88
Depreciation and obsolescence.....	1,496,872.73	1,679,323.30
Ore depletion.....	728,952.16	424,345.90
Total.....	\$3,618,010.52	\$3,020,847.00
Balance of income for six months.....	\$1,825,923.38	(a) 1,101,831.49

SUMMARY OF CONSOLIDATED PROFIT AND LOSS SURPLUS ACCOUNT

Balance at beginning of year.....	\$20,322,077.24	
Income for six months.....	1,825,923.38	
	\$22,148,000.62	
Deduct:		
Dividends on:		
Preferred stock.....	\$1,750,000.00	
Preferred "A" stock.....	194,361.00	
Preferred "B" stock.....	24,142.50	
	\$1,968,503.50	
Balance June 30, 1922.....	\$20,179,497.12	
(a) Deficit.		

The company's total balance on June 30, 1922, after deduction of preferred dividends and all other deductions, including the miscellaneous adjustments above referred to, was \$20,179,497.12, compared with a balance of \$20,322,077.24 at the beginning of 1922. Actual cash on hand amounted to \$4,426,368.44, an increase of \$2,151,941.29 over the cash on hand Dec. 31, 1921.

The consolidated balance sheet shows that total assets on June 30, 1922, amounted to \$193,281,859.35, which was an increase of \$2,671,946.62 over the total assets at the first of the current year. Loans secured by metals on hand decreased \$120,658.31 and metal stocks decreased \$979,408.65 in the six months ended June 30, 1922, and accounts and notes receivable increased \$3,979,708.45.

The report closes with a comparison of the company's financial status with that of eighteen months ago. Then the company owed banks \$12,000,000; now it has no bank indebtedness and has cash on hand of over \$5,000,000. The change has been brought about by liquidation of metal stocks, improvement in earnings, and elimination of undesirable business. The marked advance in metal prices has naturally contributed to the better financial showing.

Broken Hill South, Ltd.

Lead, Zinc; Australia

A report of operations of Broken Hill South, Ltd., for the year ended June 30, 1922, shows that the net profit for the year amounted to £235,747, after providing £35,000 for taxation payable during the current year and £33,074 for depreciation of plant. From the net profit mentioned, £13,333 has been appropriated as the annual allocation for debenture redemption and £62,400 to meet expenditure on the new plant now being erected to treat zinc tailings, leaving (with amount carried forward from previous year) an available balance of £167,425 6s. 1d. Since the closing of accounts, Dividend No. 3, of 2s. per share, was paid on Aug. 18, 1922, and Dividend No. 4, also of 2s. per share, has been declared, payable on Nov. 3, 1922. These dividends represent the distribution of £160,000.

The most striking feature of the accounts is the very large proportion of the profit which has resulted from the treatment of dump slime. It will be noted that, of the total gross profit shown in working account, £178,647 was derived from dump slime, whereas crude ore was responsible for £113,015. These figures include £54,752 which accrued from production of previous periods. Dealing only with last year's results, the treatment of dump slime yielded a gross profit of £152,245, and mining and treatment of crude ore £84,666. It is therefore evident that, notwithstanding favorable metal prices, the profit derivable from ordinary mining operations, as opposed to the combined operations of mining and dump treatment, is small under present working conditions. Dump treatment is now carrying a considerable amount of overhead working expenses which, in ordinary course, would be charged to crude ore. This figure is estimated to amount to £35,000.

For the greater part of the half year to Dec. 31, 1921, ore extraction proceeded on day shift only, the concentrating mill and flotation plant treating 2,408 tons of crude ore weekly. Dump slime to the amount of 2,418 tons per week was also treated. During the following six months two shifts were worked underground, and the average weekly quantity of crude ore treated was raised to 3,928 tons, and 2,884 tons of dump slime was dealt with per week in the flotation plant. The average weekly tonnages of crude ore and dump slime treated during the twelve months were 3,168 tons and 2,720 tons, respectively.

Rio Tinto Co., Ltd.

Copper, Pyrites; Spain

A statement issued on Oct. 7, 1922, by the Rio Tinto Co., Ltd., states that work at the mines in Spain is being carried on smoothly, under normal conditions. The cost of the materials consumed has fallen somewhat, and, though wages have not been reduced, there is an increase in the efficiency of labor. But the low price of copper, the keen competition in the pyrites market, and the suicidal policy of the Spanish Government in continuing to impose heavy export taxes, which has caused a considerable reduction in the number of men employed, collectively constitute a severe handicap. Until these adverse influences can be removed or mitigated, the operations of the company cannot be expected to show such good results as they have often done in the past.

Out of the estimated profits of the year 1922, the directors of the company have declared an interim dividend of 10s. per share on the ordinary shares. The directors have also declared the usual interim dividend for the six months ending June 30 last of 2s. 6d. per share on the 5 per cent preference shares. Both the dividends are payable on Nov. 1 next, less English income tax.

MINING STOCKS

Week Ended Oct. 21, 1922

Stock	Exch.	High	Low	Last	Last Div.	Stock	Exch.	High	Low	Last	Last Div.	
COPPER						GOLD						
Alhamek.....	Boston	62	60	60	Aug. '22, Q	\$1.00	Alaska Gold.....	New York	1 1/2	1 1/2		
Alaska-Br. Col.....	N. Y. Curb	24	22	22	Mar. '19	1.00	Alaska Juneau.....	New York	1 1/2	1 1/2		
Alloues.....	Boston	24	22	22	Mar. '19	1.00	Atlas.....	Toronto	*32 1/2	*30	*31	
Anaconda.....	New York	53	51	51 1/2	Nov. '20, Q	1.00	Carson Hill.....	Boston	8	6 1/2	7 1/2	
Arcadian Consol.....	New York	2 1/2	2 1/2	2 1/2			Cresson Consol. G.....	N. Y. Curb	2 1/2	2 1/2	Oct. '22, Q	
Aris. Com'l.....	Boston	8	7 1/2	8	Oct. '18, Q	0.50	Dome Mines.....	New York	40 1/2	38 1/2	39	
Big Ledge.....	N. Y. Curb	*10	*8	*10			Golden Cycle.....	Colo. Springs			*91	
Bingham Mines.....	Boston	18 1/2	17 1/2	17 1/2	Sept. '19, Q	0.25	Golfield Consol.....	N. Y. Curb	*6	*5	*6	
Calumet & Arizona.....	Boston	60	60	60	Sept. '22, Q	0.50	Hollinger Consol.....	Toronto	13.10	12.75	13.00	
Calumet & Hecla.....	Boston	285	280	285	Aug. '22, Q	5.00	Homestake Mining.....	New York	72 1/2	71	72 1/2	
Canada Copper.....	N. Y. Curb	*2	*1	*2			Keora.....	Toronto	*12 1/2	*10	*10 1/2	
Centennial.....	Boston	9	9	9	Dec. '18, SA	1.00	Kirkland Lake.....	Toronto	*45	*40	*42 1/2	
Cerro de Pasco.....	New York	41 1/2	39 1/2	40	Mar. '21, Q	0.50	Lake Shore.....	Toronto	2.90	2.80	2.83	
Chile Copper.....	New York	26	25 1/2	25 1/2			McIntyre-Porcupine.....	Toronto	18.30	17.50	18.00	
Chino.....	New York	29	28 1/2	28 1/2	Sept. '20, Q	0.37	Porcupine Crown.....	Toronto	*24 1/2	*23	*23 1/2	
Copper Range.....	Boston	40	39	39	Mar. '22, Q	1.00	Portland.....	Colo. Springs	*40	*35	*40	
Crystal Copper.....	Boston Curb	2 1/2	1 1/2	2 1/2			Schumacher.....	Toronto	*57	*55 1/2	*57	
Davis-Daly.....	Boston	4 1/2	4 1/2	4 1/2	Mar. '20, Q	0.25	Teak Hughes.....	Toronto	*93	*87	*92	
East Butte.....	Boston	9	9	9	Dec. '19, A	0.50	Tom Reed.....	Los Angeles	*87	*84	*85	
First National.....	Boston Curb	*51	*50	*50	Feb. '19, SA	0.15	United Eastern.....	N. Y. Curb	1 1/2	1 1/2	1 1/2	
Franklin.....	Boston	1 1/2	1 1/2	1 1/2			Vindicator Consol.....	Colo. Springs	*15	*13	*14	
Gadsden Copper.....	Boston Curb	*87	*75	*75			Vipond Cons.....	Toronto	*68	*65	*67	
Granby Consol.....	New York	31	30 1/2	30 1/2	May '19, Q	1.25	White Caps Mining.....	N. Y. Curb	*15	*14	*15	
Greene-Canaan.....	New York	28	28 1/2	28 1/2	Nov. '20, Q	0.50	Wright-Hargreaves.....	Toronto	3.40	3.15	3.30	
Hancock.....	Boston	3	2 1/2	2 1/2			Yukon Gold.....	N. Y. Curb	*95	*90	*90	
Howe Sound.....	N. Y. Curb	3 1/2	3	3	Jan. '21, Q	0.05	GOLD AND SILVER					
Inspiration Consol.....	New York	40	38	38 1/2	Oct. '20, Q	1.00	Boston & Montana.....	N. Y. Curb	*13	*12	*13	
Iron Cap.....	Boston Curb	6	6	6	Sep. '20, K	0.25	Cons. Virginia.....	San Francisco	*16	*11	*12 1/2	
Ile Royale.....	Boston	122	121	122	Aug. '22, Q	0.50	Dolores Esperanza.....	N. Y. Curb	3 1/2	2 1/2	3	
Kenecott.....	New York	35 1/2	34	35	Dec. '20, Q	0.50	El Salvador.....	N. Y. Curb	*10	*7	*4	
Keweenaw.....	Boston	2 1/2	1 1/2	1 1/2			MacNamara M.&M.....	N. Y. Curb	*8	*7	*8	
Lake Copper.....	Boston	3 1/2	3 1/2	3 1/2			Tonopah Belmont.....	N. Y. Curb	1 1/2	1 1/2	1 1/2	
Magma Copper.....	N. Y. Curb	1	1	1	Jan. '19, Q	0.50	Tonopah Divide.....	N. Y. Curb	*80	*72	*80	
Mason Valley.....	N. Y. Curb	1	1	1			Tonopah Extension.....	N. Y. Curb	3 1/2	3	3 1/2	
Mass Consolidated.....	Boston	2	2 1/2	2	Nov. '17, Q	1.00	Tonopah Mining.....	N. Y. Curb	2 1/2	2 1/2	2 1/2	
Miami Copper.....	New York	28	28	28	Aug. '22, Q	0.50	West End Consol.....	N. Y. Curb	1 1/2	1 1/2	1 1/2	
Michigan.....	Boston	2	2 1/2	2			SILVER-LEAD					
Mohawk.....	Boston	59	58	58	July '22, Q	1.00	Caledonia.....	N. Y. Curb	*8	*8	*8	
Mother Lode Coa.....	N. Y. Curb	15	15	15	June '22, I	0.50	Cardiff M. & M.....	Salt Lake	*56	*50	*50	
Nevada Consol.....	New York	18	17 1/2	17 1/2	Sept. '20, Q	0.25	Chief Consol.....	Boston Curb	5 1/2	5 1/2	5 1/2	
New Cornelia.....	Boston	10 1/2	10 1/2	10 1/2	Aug. '22, K	0.25	Columbus Rexall.....	Salt Lake	*25	*25	*25	
North Butte.....	Boston	10 1/2	10 1/2	10 1/2	Oct. '18, Q	0.25	Consol. M. & S.....	Montreal	27	26	26 1/2	
Ohio Copper.....	N. Y. Curb	*53	*32	*52			Eagle & Blue Bell.....	Boston Curb	*3	*3	*3	
Old Dominion.....	Boston	21	19	19	Dec. '18, Q	1.00	Electric Point.....	Spokane	*8 1/2	*6	*6	
Oseola.....	Boston	32	32	32	Aug. '22, Q	1.00	Federal M. & S.....	New York	*15	*12 1/2	15	
Phelps Dodge.....	Open Mar.	*175	*165		Oct. '22, Q	1.00	Federal M. & S. pfd.....	New York	59	58	58	
Quincy.....	Boston	39	38	38	Mar. '20, Q	1.00	Florence Silver.....	Spokane	*37 1/2	*35 1/2	*37 1/2	
Ray Consolidated.....	New York	14 1/2	14 1/2	14 1/2	Dec. '20, Q	0.25	Grand Central.....	Salt Lake	*65	*60	*61	
Ray Hercules.....	N. Y. Curb	1	1 1/2	1 1/2			Hecla Mining.....	N. Y. Curb	7 1/2	7 1/2	7 1/2	
St. Mary's Min. Ld.....	Boston	44	43	43	Apr. '22, K	2.00	Iron Blossom Con.....	N. Y. Curb	*26	*26	*26	
Seneca Copper.....	Boston	79	77 1/2	77 1/2	Nov. '17, Q	0.25	Marsh Mines.....	N. Y. Curb	*15	*11	*13	
Shannon.....	Boston	*79	*71	*71	Nov. '20, Q	0.25	Prince Consol.....	Salt Lake	*14	*11	*11	
Shattuck Arizona.....	New York	8 1/2	8 1/2	8 1/2	Jan. '20, Q	0.25	Rambler-Cariboo.....	Spokane	*8	*7	*7	
South Lake.....	Boston	11	10 1/2	10 1/2			Stewart Mines.....	N. Y. Curb	*8	*7	*7	
Superior & Boston.....	Boston	10	9 1/2	9 1/2	May '18, I	1.00	Tamarack-Custer.....	Spokane	3.30	3.20	3.20	
Tenn. C. & C. etc.....	New York	10	9 1/2	9 1/2	May '13, I	0.10	Tintic Standard.....	Salt Lake	3.27 1/2	3.15	3.25	
Tuolumne.....	Boston	*55	*50	*50	May '13, I	0.10	Utah Apex.....	Boston	2 1/2	2 1/2	2 1/2	
United Verde Ex.....	Boston Curb	29	28	28 1/2	Aug. '22, Q	0.25	IRON					
Utah Consol.....	Boston	2 1/2	1 1/2	1 1/2	Sept. '18, I	0.25	Bethlehem Steel "B".....	New York	78 1/2	73 1/2	74 1/2	
Utah Copper.....	New York	68 1/2	66 1/2	67 1/2	Sept. '22, Q	0.50	Char. Iron, pfd.....	Detroit	2 1/2	2 1/2	2 1/2	
Utah Metal & T.....	Boston	1 1/2	1 1/2	1 1/2	Dec. '17, I	0.30	Colorado Fuel & Iron.....	New York	33 1/2	31	31	
Victoria.....	Boston	1 1/2	1 1/2	1 1/2			Col. Fuel & Iron, pfd.....	New York	105	105	105	
Winona.....	Boston	1 1/2	1 1/2	1 1/2			Gt. North'n Iron Ore.....	New York	39 1/2	33 1/2	34	
Wolverine.....	Boston	9	8 1/2	8 1/2			Inland Steel.....	N. Y. Curb	48 1/2	48 1/2	48 1/2	
NICKEL-COPPER						ASBESTOS						
Internat. Nickel.....	New York	17 1/2	15 1/2	15 1/2	Mar. '19, I	0.50	Asbestos Corp.....	Montreal	73 1/2	71 1/2	73	
Internat. Nickel, pfd.....	New York	79 1/2	79 1/2	79 1/2	Aug. '22, Q	1.50	Asbestos Corp. pfd.....	Montreal	87	86	87	
LEAD						SULPHUR						
Carnegie Lead & Zinc.....	Pittsburgh	5 1/2	5 1/2	5 1/2	Sept. '22, Q	1.50	Freeport Texas.....	New York	27 1/2	23 1/2	23 1/2	
National Lead.....	New York	114 1/2	108 1/2	113	Sept. '22, Q	1.75	Texas Gulf.....	New York	65	59	61	
National Lead, pfd.....	New York	114	111 1/2	112 1/2	Sept. '22, Q	1.75	MINING, SMELTING AND REFINING					
St. Joseph Lead.....	New York	18 1/2	18 1/2	18 1/2	Sept. '22, Q	0.25	Amer. Metal.....	New York	50 1/2	48 1/2	48 1/2	
QUICKSILVER						VANADIUM						
New Idria.....	Boston	*25	*20	*25			Vanadium Corp.....	New York	47	43	43 1/2	
ZINC						ASBESTOS						
Am. Z. L. & S.....	New York	19 1/2	18 1/2	18 1/2	May '20, I	1.00	Asbestos Corp.....	Montreal	73 1/2	71 1/2	73	
Am. Z. L. & S. pfd.....	New York	54	52 1/2	52 1/2	Nov. '20, Q	1.50	Asbestos Corp. pfd.....	Montreal	87	86	87	
Butte C. & Z.....	New York	7 1/2	7 1/2	7 1/2	June '18, I	0.50	SULPHUR					
Butte & Superior.....	New York	34	32 1/2	33	Sept. '20, Q	0.50	Freeport Texas.....	New York	27 1/2	23 1/2	23 1/2	
Callahan Zn-Ld.....	New York	9 1/2	8 1/2	8 1/2	Dec. '20, Q	0.50	Texas Gulf.....	New York	65	59	61	
New Jersey Zn.....	N. Y. Curb	17 1/2	170	171 1/2	Aug. '22, Q	2.00	MINING, SMELTING AND REFINING					
Yellow Pine.....	Los Angeles			*65	Sept. '20, Q	0.03	Amer. Metal.....	New York	50 1/2	48 1/2	48 1/2	
SILVER						VANADIUM						
Batopilas Mining.....	New York	3 1/2	3 1/2	3 1/2	Dec. '07, I	0.12 1/2	Vanadium Corp.....	New York	47	43	43 1/2	
Beaver Consol.....	Toronto	*34	*32	*32 1/2	May '20, K	0.03	ASBESTOS					
Coniagas.....	Toronto	1.80	1.70	1.80	May '21, Q	0.12 1/2	Asbestos Corp.....	Montreal	73 1/2	71 1/2	73	
Crown Reserve.....	Toronto	*28	*25	*28	Jan. '17, Q	0.05	Asbestos Corp. pfd.....	Montreal	87	86	87	
Kerr Lake.....	N. Y. Curb	3 1/2	3 1/2	3 1/2	Oct. '22, Q	0.12 1/2	SULPHUR					
La Rose.....	Toronto	*25 1/2	*23 1/2	*25 1/2	Apr. '22, Q	0.10	Freeport Texas.....	New York	27 1/2	23 1/2	23 1/2	
McKinley-Dar-Sav.....	Toronto			*26	Oct. '20, Q	0.03	Texas Gulf.....	New York	65	59	61	
Mining Corp. Can.....	Toronto	1	1	1	Sept. '20, Q	0.12 1/2	MINING, SMELTING AND REFINING					
Nipissing.....	N. Y. Curb	6	5 1/2	5 1/2	Oct. '22, Q, X	0.30	Amer. Metal.....	New York	50 1/2	48 1/2	48 1/2	
Ontario Silver.....	New York	7	7	7	Jan. '19, Q	0.50	Amer. Metal pfd.....	New York	112 1/2	111	112 1/2	
Temiskaming.....	Toronto	*33 1/2	*32	*32	Jan. '20, K	0.04	Amer. Sm. & Ref.....	New York	64 1/2	60	61 1/2	
Trethewey.....	Toronto	*5 1/2	*4 1/2	*5 1/2	Jan. '19, I	0.65	Amer. Sm. & Ref. pfd.....	New York	103 1/2	101	103 1/2	

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.
 Toronto quotations courtesy Hamilton P. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, The Financial Press, N. Y.

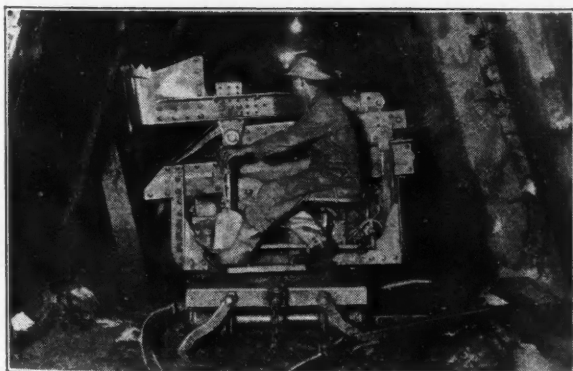
NEW MACHINERY AND INVENTIONS

Underground Loader Embodies Steam-Shovel Features

REDUCING underground loading costs in metal-mining operations is a question that has engaged the attention of mine operators for many years, and that has resulted in much experimental work on mechanical shoveling devices that can be used underground and in surface work as well. It is generally agreed among mining men that the greatest cost of underground operation is hand shoveling, and as a substitute for this the Hoar Shovel Co. has spent several years in perfecting the shoveling device which it is now producing and which it is claimed has obliterated the early difficulties encountered in machines of this sort.

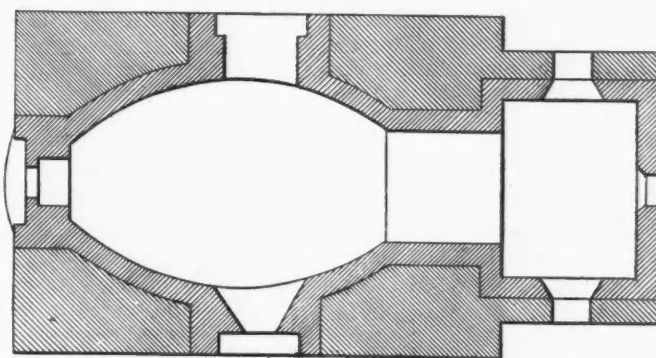
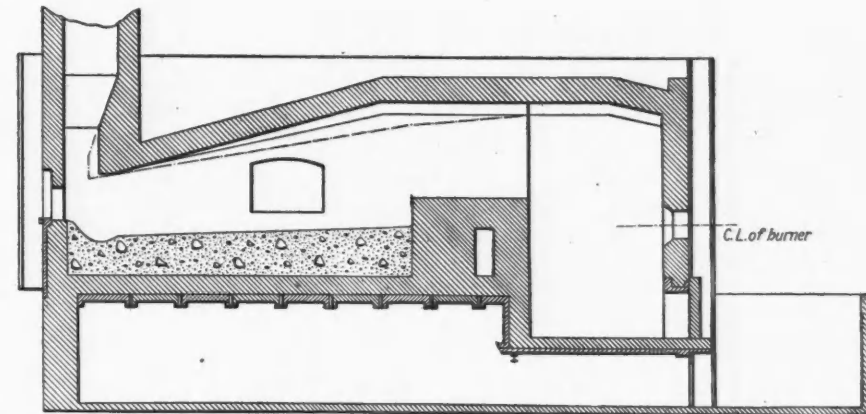
The Hoar shovel has been developed with the purpose of producing what might parallel the steam shovel in surface work. It is built on the same general plan, with refinements to adapt its performance to underground mining conditions. It has maintained a loading average of 125 one-ton cars per eight-hour shift in extreme hard digging, handling chunks as large as 1,500 lb., and in soft ore can easily average 200 tons per shift. A working space of 5½ ft., and under special conditions even a drift 4½ ft. wide, is sufficient to give it room for loading, trimming, and spotting its own cars.

The machine is mounted on a truck, which in turn is mounted on 8-in. wheels in front and 12-in. wheels at the rear. The body of the machine is swung in either direction through a complete circle on double ball-bearings by a reversible air motor. Although



Mechanical shovel which requires small operating space

the loader is compactly made, so that it will operate in the smallest possible compass, the range and flexibility of the clean-up radius are important and noteworthy. As ordinarily built, the shovel will clear up a circle 16 ft. in diameter without moving. The dipper can be dumped anywhere within its reach, and the shovel does all of its



Blister furnace of seven and one-half ton capacity for refining copper

own trimming. It is a one-man outfit operated by three levers. It is easily lowered into the mine.

Recent improvements in the construction of the Hoar shovel include steel castings, which have been substituted for structural framework, making the new machines of steel castings throughout. The power units have been rearranged so that they are more accessible and enable all of the power plant to be fully inclosed. A foot lever has been added, operating an air cylinder which thrusts the dipper carriage forward,

the dipper dropping into the digging position without the use of the crowding engine. This permits a greater clean-up from one digging position, cutting down by one-half the number of times the shovel has to be moved forward to clean up. All parts of the new shovel have been made heavier. An alteration has been made in the double dipper stick, which permits a greater clean-up radius. The dipper capacities have been increased, giving a range of from 4.1

cu.ft. to 12 cu.ft. The engines used are reversible air motors, powerful, well built, and easily controlled, and are double reciprocating.

The shovels are made in a number of sizes suitable to various underground requirements. Complete details can be had by addressing the Hoar Shovel Co., Inc., Sellwood Building, Duluth, Minn.

Powdered Coal in Copper Refining

A convincing comparative test of powdered-coal vs. hand-firing has recently been made at the copper-refining plant of Société Anonyme des Mines et Fonderies de Pontgibaud, in France. This company operates four blister furnaces at seven and a half-ton capacity, which heretofore have been hand-fired.

After fitting up one of the furnaces for powdered-coal firing, a series of tests was conducted to determine relative production and costs. The results obtained showed a saving of 30 per cent in fuel used and a 25 per cent decrease in the time required per heat.

Comparative results of the two methods of firing were as follows:

	Hand-Fired	Powdered-Coal-Fired
Amount of copper refined per heat in furnace, lb. . . .	16,500	16,534
Total time required per heat, hours . . .	24	17½
Total coal consumed per heat, lb.	5,300	3,682

No difficulty was experienced in the powdered-coal operation, and the refined product was reported to be of as good quality as that of the hand-fired equipment.

The series of tests covered a period of several weeks, and an examination of the furnace at the conclusion showed the entire furnace to be in first-class condition and the linings in no way damaged by the new method of firing.

The accompanying drawing shows the powdered-coal furnace used, which was designed by Quigley Fuel Systems,

Inc., of New York, the tests being conducted with the co-operation of the company's resident engineer in France.

The History of Rubber Hose

BY E. J. BLACK

The first fire hose was invented in 1672, and consisted of a narrow strip of leather with the edges riveted together so as to form a tube. Leather fire hose of this type was first made in America in the year 1808, in Philadelphia.

Rubber hose was first produced in England, about one hundred years ago. It was made by braiding threads of rubber on a core of rope coated with molasses and glue. It was then treated with chemicals so that the rubber threads became incorporated, after which the core was removed by boiling.

The next type of rubber hose appeared about 1859. It was made by weaving cotton yarn into a flat strip, coating it on one side with rubber, and then turning it on a mandrel and riveting the edges together as in leather hose. Sometimes hose was made with two plies of this sort, each ply being riveted separately.

After this, in 1877, came the invention of the loom for weaving a seamless tube of cotton, which made possible the type of cotton rubber-lined hose now so extensively used as fire hose. A somewhat similar process is adopted in making the many different kinds of reel hose which are so widely used as air and water hose.

Last of all was developed the idea of coating fabric with rubber friction, cutting it into bias strips wide enough to make several plies, attaching a flat strip of rubber at one side to form the outer cover, and then winding the whole thing around a rubber tube on a rod or mandrel of the desired size, permitting the adhesive power of the rubber to hold the various plies together without the use of rivets. This economical and efficient method is now in general use.

INDUSTRIAL NOTES

Dwight P. Robinson & Co., Inc., has been awarded a contract for the construction of a cement mill at Birmingham, Ala., for the Lehigh Portland Cement Co., of Allentown, Pa. The mill will have a capacity of 1,000,000 bbl. a year.

Ruggles-Coles Engineering Co., New York, report recent shipments of Ruggles-Coles driers as follows:

A Class A-14 drier to the Stott Briquet Co., Superior, Wis., for drying coal; a Class A-8 drier to T. H. Symington Co., Rochester, N. Y., for drying coal in that company's pulverized-coal plant; a Class F-O drier to the Silica Products Co., Lowville, N. Y., for drying sand; a Class F-10 drier to China for drying match splints; a Class B-2

drier to Salt Lake Insecticide Co., Salt Lake City, Utah, for the drying of calcium arsenate; a Class B-2 drier to the Aluminum Flake Co., Barberton, Ohio, for drying clay by direct heat before pulverizing, and a Class A-12 drier to the Brown Corporation, La Toque, Quebec, Canada, for drying lime sludge.

J. B. Clark, Jr., has recently become associated with the Pennsylvania Crusher Co., Philadelphia, as sales engineer, and will make his headquarters at the company's New York office, Hudson Terminal, 50 Church St. For a number of years, Mr. Clark has been associated with the Koppers company, of Pittsburgh, in the erection and operation of byproduct coke plants, including the Seaboard plant, at Jersey City. Mr. Clark will give particular attention to engineering co-operation in connection with the installation of coal-preparation machinery.

TRADE CATALOGS

Crushing Rolls—Allis-Chalmers Manufacturing Co., Milwaukee, Wis., in its bulletin No. 1816-A, illustrates various types of crushing rolls, together with sectional diagrams and tables showing sizes and dimensions.

Ball Mills—The Braun Corporation, Los Angeles, Cal., has issued a four-page leaflet descriptive of the Herman screening ball mill. A flow sheet, a typical installation, and a cut of the Herman machine are shown.

Centrifugal Pumps—The Coeur d'Alene Hardware & Foundry Co., of Wallace, Idaho, has issued bulletin No. 21, consisting of twenty pages and containing a description of the new Wallace ball-bearing slime, sand, and water centrifugal pump. Several cuts and a number of useful tables are included.

Reagent Feeders—The General Engineering Co., of Salt Lake City, Utah, announces in a one page leaflet the Geco flotation oil and reagent feeder, which is said to be the latest development in a machine for proper control in feeding oils or reagents in flotation plants. Capacities and general specifications are given.

Wood Preservatives—The Century Wood Preserving Co., Century Building, Pittsburgh, Pa., in its bulletin No. 24 details the methods of treating ties and timbers for industrial plants. The processes of wood preservation, seasoning, preparation, and handling are reviewed, and a number of tables are included. The pamphlet is well illustrated and should be of considerable interest to all mine operators.

Drying Machinery—The Colorado Iron Works Co., Denver, Col., in its catalog No. 32-B treats with the drying of fine materials and includes a description of the Lowden patent drier. This book, of thirty-two pages, is arranged in textbook form and is an excellent treatment of the subject. A number of views of plants where installations of

the Lowden driers are used are shown, together with explanatory diagrams of the machine.

Steam Shovels—The Marion Steam Shovel Co., Marion, Ohio, has issued bulletin No. 304, illustrating and describing the new Model 37 steam shovel, which carries as regular equipment a 25-ft. boom, 17-ft. dipper handle, and 1½-cu. yd. dipper. It is readily convertible into drag-line, clamshell or orange-peel excavator or material-handling crane, and can be furnished with either rigid or flexible crawler mounting, traction wheels, or railroad wheels.

Line Shafting Equipment—The Medart Co., formerly the Medart Patent Pulley Co., of St. Louis, Mo., has issued catalog No. 43, which presents facts about the most generally used line shafting equipment. The aim has been to state dimensions, details of construction, and list prices in a way to enable engineers, designers, mechanics, and power users to plan installations and purchase the equipment described. The arrangement is good, and the book contains a mass of valuable information.

Engineering Instruments—W. & L. E. Gurley, Troy, N. Y., have recently issued a new catalog, which is liberally illustrated and describes in an admirable manner the several products of this old-established firm. A concern that has maintained a reputation for precise workmanship and excellence of product for more than seventy-five years is worthy of a high place in American industry and that this reputation is justified is evident from the complete line of transits, levels, and other surveying apparatus displayed and described in the new catalog.

Stokers—The Combustion Engineering Corporation, New York City, has recently issued Bulletin CB1, "The Coxe Stoker," and an accompanying booklet entitled "Service." The bulletin on the Coxe stoker covers particularly the performance of this stoker on western and mid-western bituminous coals. A number of test reports, each accompanied by corresponding curves, are included. These tests show remarkable results, and because they are complete in every respect they will be of considerable interest to engineers. Three years ago it was thought impossible to burn bituminous coal on Coxe stokers, or any forced-draft traveling-grate stokers. Today there are a number of highly successful installations in some of the biggest and most important plants in the middle west. Pictures of a number of them are shown in the bulletin. The "Service" bulletin, though issued by the company, will be of value to all stoker companies. At the present time it is necessary for stoker manufacturers to render gratuitously service of a costly nature. This booklet presents the stoker manufacturers' side of the question and shows why a proper charge for real stoker service would not only be fair to the recipient but would be to his advantage. It is illustrated with an interesting cartoon story.