

ENGINEERING AND MINING JOURNAL-PRESS

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April 11, 1925



The Electric Shovel

By D. J. Shelton

Steam equipment still predominates, but the rapidity with which transmission lines are being extended and the increasing availability of power at equitable rates in nearly all localities make it seem reasonable to assume the existence of a widening field for the electric drive. Problems and features of design are discussed by an expert in this article.

New Dry at the Montreal Mine

By L. D. Stewart

Sanitation, convenience, economy and safety have all been considered in the design of this recently constructed change house in the Lake Superior iron country. Full details and drawings are given for the benefit of other operators.

Geology of the Verde Central Mine

By J. L. Fearing, Jr., and P. C. Benedict

Recent developments on the fourteenth level of this property have perhaps caused many to ask if the Jerome district, in Arizona, is to have a third producer. The possibilities of finding new orebodies are here given careful consideration.

Ruhr

Iron and Steel Industry Under the Dawes Plan

By C. K. Leith

A sketch of the situation resulting from recent developments in the relations between Germany and France.

Amphibole Asbestos Deposits

at Hollywood, Ga.

Their Development and Treatment

By L. B. Reifsneider

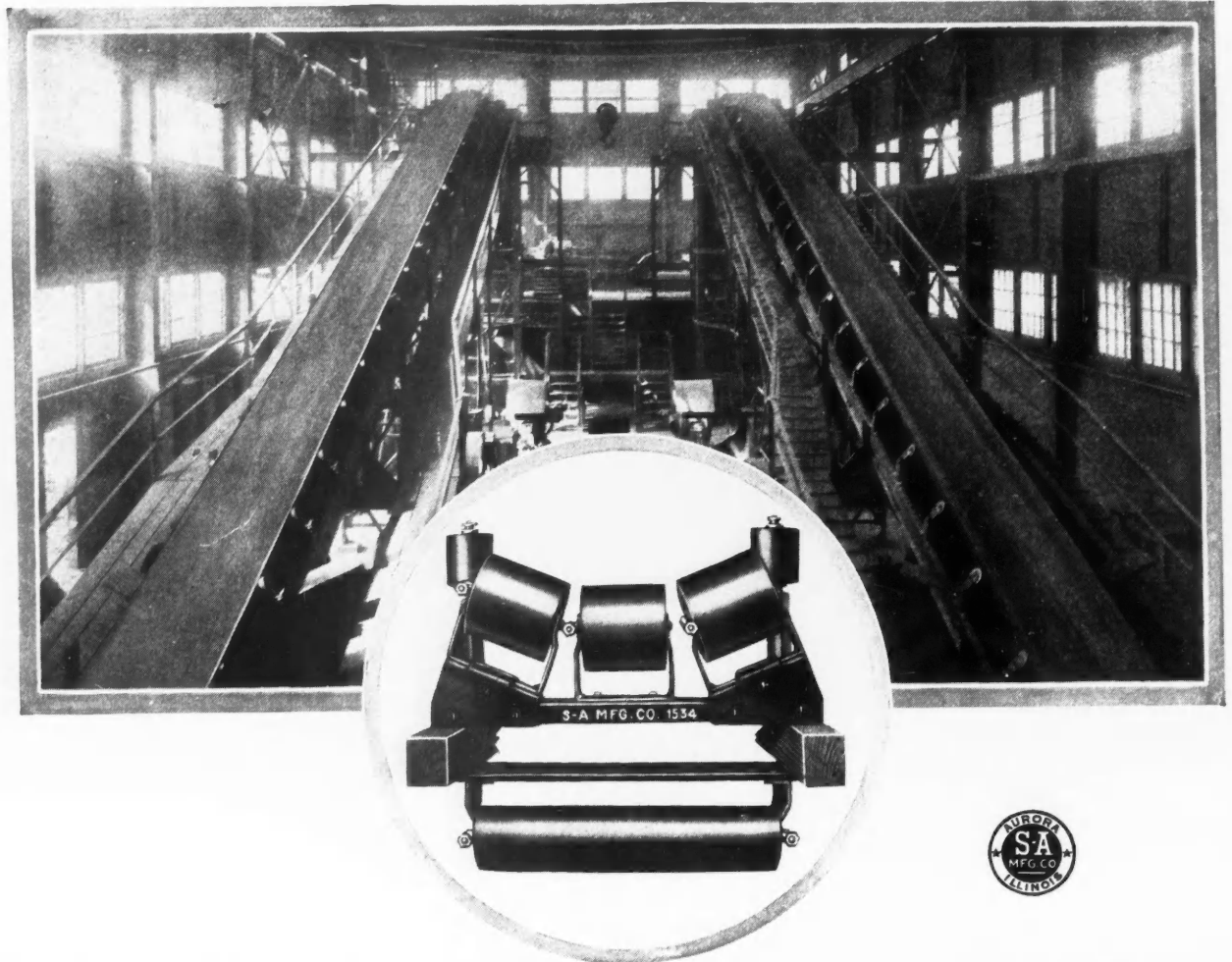
Much experimental work remains to be done, but the writer believes that eventually the various grades of short fibres referred to will be found fully as valuable as the Canadian product.

Wastage of Petroleum

The so-called Doherty plan for conserving the country's oil resources comes in for criticism by H. A. Wheeler, whose letter appears in the Discussion pages. Other topics are "New Mines," which is treated by Percy Williams, and "Mining Finance," by a person who is interested in mine promotion in New Mexico.

Next Week

Recent Developments in Open-pit Mining, By Robert Marsh, Jr.



Ball-Bearing Carriers of All-Steel

Belt conveyor shut-downs for lubrication, failures or other causes, are usually pretty expensive because so many machines dependent upon the belt conveyor are tied up.

It is such expensive interruptions that S-A Unit Carriers help to prevent.

S-A Unit Carriers are constructed of seamless steel tubing with pressed steel end plates. The rigid supporting stands are of pressed steel and mounted on structural steel channels—this construction forms a unit that is practically indestructible.

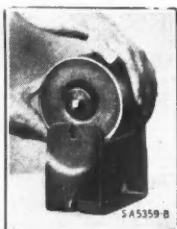
S-A Unit Carriers are packed with grease at the factory and will run for months without further attention. The same unit can be furnished with fittings for high pressure lubrication where desired.

The general adoption of the belt conveyor as a mechanical carrier of ores and kindred materials has in a large measure been due to the unsurpassed service which S-A Unit Carriers have rendered in this field.

If a material handling problem confronts you, the experience of S-A Engineers is at your service.

Stephens-Adamson Mfg. Co.

Aurora, Illinois



*Designers and Builders of Labor-Saving
Material Handling Machinery*

The illustrations show the two styles of ball bearing Units for S-A Unit Carriers. On the left is the well-known Unit with plain lubrication. On the right is the new Unit equipped for high-pressure lubri-

cation. Both Units are interchangeable and one style can be quickly replaced by the other. Write for booklet, "The New S-A Unit."



ENGINEERING AND MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

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Number 15

Dollars Saved and Earned

MORE THAN ONE COMPANY after undertaking to utilize waste products has been agreeably surprised to find the branch enterprise more profitable than the original one. Years ago mining and reduction methods were often inefficient and wasteful. Time and patient effort changed this, and today the larger companies at least are winning their metal with a high degree of efficiency. Improvements in metallurgy led to the re-treatment of old tailings. Coming closer to the present, the tailings themselves began to be used, and for a constantly widening variety of purposes—for road material, concrete aggregate, and other building purposes, and as fertilizer or soil dressings where the chemical composition permitted. The manufacture of acids and liquid SO_2 from smelter gases and the use of slag for ballast, cement, fertilizer, and similar purposes are other now familiar ways of making an extra profit. A careful study of the average plant will probably reveal something being thrown away that study might show could be saved with profit—values in flue dust and mill dust, metal in mine waters, salts and acids in waste solutions, even water that often has been pumped at considerable expense—to say nothing of the waste due to crude methods of dressing and grading in preparing many of the non-metallic minerals for market. Presumably the average superintendent has already given this matter due attention; if he has not, it might pay him to look around and see where he can make a saving, even if this involves the breaking of local traditions.

Aside from the direct profit that utilizing byproducts may offer, their development tends toward a greater diversification of industry—something of benefit to every resident of a mining district as well as to the companies themselves. A region having well-diversified industries is almost sure to be a better place to live in than one that depends on mining only. Increased opportunities for employment are offered to the children of miners, the floating population diminishes, and in general conditions in this respect become more stable and easier for the operator.

Within recent years Australian mining companies have undertaken the manufacture of secondary products to a marked extent. The Mount Lyell company has fertilizer works in Melbourne and Freemantle, and is interested in others in South Australia. Its chemical plant produces electrolytic caustic soda, liquid chlorine, sodium hypochlorite, and hydrochloric acid. The Sulphide Corporation has turned its attention to superphosphate and cement. Broken Hill Proprietary has long been making iron and steel at Newcastle in New South Wales. Amalgamated Zinc, the father of Electrolytic Zinc in Tasmania, was recently considering the making of paper from Tasmanian timber. Mount Morgan, Hampden-Cloncurry, and Mount Lyell were all interested in the establishment of Metal Manufacturers,

Ltd., at Port Kembla, which is making copper rods, wire, and bars, insulated cable, aluminum-steel cored conductors, and the like. Other cases can be cited abroad and at home. It is likely that the future will see the number of such instances greatly increased.

Stock-raising Homestead Act and the Prospector

THE RESIDUAL PART of the public domain is fast disappearing, and it is almost unnecessary to state that the land that constitutes this residual part is the least desirable of all that has been appropriated. Through the operation of various enactments such as the Homestead Act, the Timber and Stone Act, railroad grants, desert-land grants, forest reservations, allocation of school lands, the National Monuments and Parks law, grazing permits, withdrawals of various kinds, patented mining claims and mining claims held by assessment, there has resulted a progressive diminution in the amount of unappropriated land.

The Stock-raising Homestead Act, passed in 1916, was one of the last enactments that made available for appropriation by private parties land that is in many instances of little value except for prospecting. We suspect that stock-raising interests were responsible for the initiation of this law, which authorizes the Secretary of the Interior, on application or otherwise, to designate as stock-raising lands, subject to entry under the act, lands the surface of which is, in his opinion, chiefly valuable for grazing and raising forage crops, that do not contain merchantable timber, are not susceptible of irrigation from any known source of water supply, and are of such character that 640 acres are reasonably required for the support of a family. Mineral and the right to prospect them are especially reserved, but the prospector who has the hardihood to re-enter such lands must first obtain the written consent of the homestead entryman or patentee, pay damages to "crops" or other tangible improvements, or file a bond to the United States to secure payment for such possible damages. Also, lands containing water holes or other bodies of water needed or used for watering purposes *by the public* are exempted from appropriation. By the making of improvements of \$800 and the payment of Land Office fees and other incidentals, bringing the total to about \$1,000, the entryman obtains a square mile of the public domain.

Apparently the act conserves the conflicting rights of the miner and the general public; but necessarily it obstructs prospecting. Obviously, land of the kind intended by the act will not support a family, however heroic the effort to make it do so may be. Such lands ultimately pass into the control of the larger stock men, and these men are not generally sympathetic to the prospector. Few prospectors are in a position to furnish a bond such as is required.

One discovery of a mine is worth more in an eco-

conomic sense than many grazing homesteads. It would be better national policy to leave as much land open to the prospector as possible. A more liberal land classification would be a wholesome thing for the mining industry. The Stock-raising Homestead Act should be repealed in the interest of conserving available land for prospecting. In land classification the benefit of the doubt should be thrown in favor of the miner, as he has least representation and is usually without the means to fight adverse claimants.

Growth and Change

IN TENNESSEE, the legislature has prohibited the teaching of "evolution," and the Governor has signed the bill making it a law. In his comment, the Governor repudiates, as vigorously as the brilliant Bryan has done, any anatomical resemblance between the ape and the man, affirming anew that man is made in the image of God; that is to say, that God is in the image of man, with legs and arms and a spinal column, quite as the old ecclesiastical paintings show. It takes a very thoughtless kind of man to make such an irrelevant statement in these advanced days; but the Governor is quite solid in his opinion that he resembles the Creator and the Creator resembles him; moreover, that he resembles nothing but the Creator, and that all suspicions to the contrary attack the fundamentals of religion.

The success of a republic depends not upon the ability to govern of the majority, which is apt to be insufficient, but on the numbers of an intelligent minority and their ability to lead the less intelligent masses, who are unable to solve large questions. The intelligent minority are to blame for letting the Governor and Mr. Bryan and the rest of the majority understand that "evolution" was a "doctrine." Evolution merely means the change from one thing to another. The development of human organization and civilization from the condition a hundred years ago to that of today is an astounding example of evolution. The development by breeding of a race horse, a prize hog, or a special breed of dogs, is evolution; and human history records many such striking developments. Going a little further back, and reading the records of skeletons incased in the rocks, even greater changes are shown, as the development of the horse by easy stages from a little five-toed animal the size of a dog. This is the development, or evolution, of a horse.

The mining engineer and miner are perforce intellectuals. Few, if any, believe that a vein of ore was molded, in its present shape, for the especial use of man, by an anthropomorphic Deity, since which creation it has undergone no change. He perceives changes that have taken place in the rocks; and his thought as to ore deposits is all as to exactly what age-long development has left them in their present form. This development is evolution. The growth of mountains through uplift and erosion is evolution—the evolution of the earth's face. The true fundamentalist denies this, along with the evidence of man's anatomical similarity to his animal contemporaries. No stream, indeed, flows to the sea laden with mud; no earthquake shakes down a cliff, but it would affront the so-called religion of this type, if one holding to it paused to think. But he does not think: he ignores all ideas of evolution until the horns of his own ego are trodden upon, where-

upon he makes "laws" against such impertinence. Yet he himself is an example of evolution, for by comparing him with the leaders of scientific and religious thought, one perceives what towering eminences have grown from the dead level of a type which lives solely by its tradition and by the instincts which a wise Providence has made a part of its mechanism.

Price Declines Not Confined to Metals

THE RECENT COURSE of metal prices has been distinctly disappointing; many reasons have been suggested for the decline, and much thought has been given to the probable course of the market during the next few months. Since January, copper has declined 1½c., lead 2½c., zinc ¼c., tin 8c., and silver 2½c., or, expressed as percentages of the January level, the declines have been 11, 20, 11, 13, and 3½ per cent respectively. All of the important non-ferrous metals in which a free market exists have shared in the decline—copper to no greater extent than tin, zinc, and lead—so the real reason for the disappointing condition is probably a far-reaching one, for which any one group can hardly be blamed.

The last three months have also witnessed a pronounced let-up in other industries; grain prices have fallen materially; securities in the stock market have recorded a decline of considerable importance; and the purchasing power of the dollar has begun going up instead of continuing its downward trend. It seems to have been realized that the post-election optimism was carried too far, and commodities, generally, have suffered in the reaction.

On the other hand, there is no indication that business is going to the dogs, and there is every expectation by the well-informed that better prices will be realized for securities and commodities this spring; nothing like a boom, but merely more satisfactory conditions and a more normal correlation of values. Metal prices should reflect this improvement as they have been affected by the general reaction. Of course, there is less likelihood that a metal that is selling for a relatively high price, such as lead, will make a material advance, than there is that copper prices, for example, will improve.

Consumers, generally, have been buying very cautiously lately, and they have no large stocks of metal on hand; neither have producers. Buying should improve as soon as there are indications of greater stability in the price level. All the ground lost in the recent reaction may not be made up, however.

The Literature of Optimism

THE doodle-bugs, like the army ants, march on, regardless of obstacles of fact, truth, science, economics, common sense, or any other thing on the earth, or below the earth, or above the earth. One of the gentlemen whose ore-finding machine and the literature describing it we cited recently with the faintest and politest sarcasm, telegraphed us last week intimating action for libel, saying the publicity we had given him had ruined his business. This cheered us up: at least we have not lived in vain.

Our readers are, however, still looking for the real thing: and a correspondent in Utah sends us the following bona fide letter, which he assures us is sufficient

evidence. We give it without taking any editorial liberties whatever. It was written by a man in New Jersey to one in Utah:

March 16, 1925.

W. H. Ackerman,
711 E. 26th St.,
Paterson, N. J.

Mr. S. M. Mitchell,
Park City,
Utah.

Dear Mr. Mitchell:

Your letter of Feb. 13 came in due time and I have read and re-read your letter so I would get the essences of your mind as to the Perry Indicator.

I am sorry to say that your letter shows that instead of humiliation and willing to ask further questions you have through pride (which goes before a fall) jump at conclusions which is very bad fault of the majority of people in the world today to form an opinion not knowing upon what grounds it is built upon, your statement that this proposition sounds more like an experiment than an actual facts, and if in the course of a year or more time the Indicator is proven to be all right etc.

Why Mr. Mitchell I am greatly surprize (no I am not surprize at all. Why? You may have the privilege to learn later.) to hear such statements made about the Indicator in question because there is about six years of operation and about two thousands locations and proven claims back up by developments without one failure behind Mr. Perry Indicator and his claims as pertaining to any minerals, oils locations, depths, widths, commercial values, etc., or in other words he can positively tell you where the richest ore is, the width, depth, size of veins, etc. so you can know exactly all about the hidden formation before you spend one cent of money or valuable time by knowing all there is in advance. Most assuredly you could save months or years valuable time which would also save very large sums of the stockholders money, for would you consider for a moment to use a letter or telegraph operator if you could get the same message or results by Radio.

As I have been informed since I wrote you before that Mr. Perry has tied up with a large New York corporation (you cannot buy the Indicator) but if you are willing to make further investigations (which I strongly advise you to do) I can find out quickly through a New York friend if you can get Mr. Perry to operate on any of your mining properties. Expecting to hear from you promptly.

Yours truly,
W. H. Ackerman.

Business Forecast

BUSINESS FORECASTS are like weather forecasts: interesting and inevitable, and frequently correct. For this reason we take unusual interest in the survey of business recently given out in abstract by the National Industrial Conference Board of New York. This organization forecasts "a stable, sound, and even flow of business activity for the remainder of the year." There is further predicted stationary wages, a tendency in some industries toward lower prices, and rising interest rates. The survey concludes that the mechanism of business has improved during the last five years, that there is greater elasticity of production without necessarily corresponding waves of employment and unemployment. There has been established better and more direct contact between manufacturer and consumer; greater reliability of transportation; and a tendency to cut out speculative buying.

As to specific and representative industries, the well-known fact is pointed out that agriculture does not consider itself prosperous, that there is an ominous depression in farm produce prices. There is some question in our minds as to the correctness of this popular view of the farmers' "predicament," but we cite it

among the rest. As for the railroads, a good volume of business is predicted, and for the electrical industry as well. In the automobile industry there is an encouraging increase in the export trade, and a good volume of business is looked for for the rest of the year.

The metals trades, the Industrial Conference Board considers, have become stabilized more than at any time since 1920. Wages are expected to remain almost stationary, with a tendency toward lower prices for products, due largely to keener competition. Production in the metal trades industry at present runs about 80 per cent, compared with 1924, or 65 to 75 per cent, compared with the peak period of 1920.

In the steel-production industry there is predicted a retrenchment of production, with a stiffening of prices, but business at a good level till at least the middle of the year. Adequate coal production is assured.

This general survey will be of some interest to the mining industry, especially the consideration as to general prosperity and the outlook for the metals trades, which concerns the products of the mining industries. Fundamental conditions appear sound, and even encouraging. Nevertheless, there is such a complex of minor factors affecting any specific mining industry that the outlook for it is not to be expressed in generalities. Each man will study the horizon for himself, and make up his mind as to whether to sail or lie in harbor.

Developing Africa's Mineral Wealth Requires Time and Money

SOME FEARS have been expressed by the Belgians that English and American capitalists might try to wrest control of the Katanga copper properties now owned by the Union Minière. The shares of this company are closely held, but the shares of Tanganyika Concessions, which owns a quarter interest in the Union Minière as well as properties of its own, are freely sold in London. Investors in the United States have shown an interest in these two African companies, as well as in the Bwana M'Kubwa Copper Mining Co. and the Rhodesian Congo Border Concession.

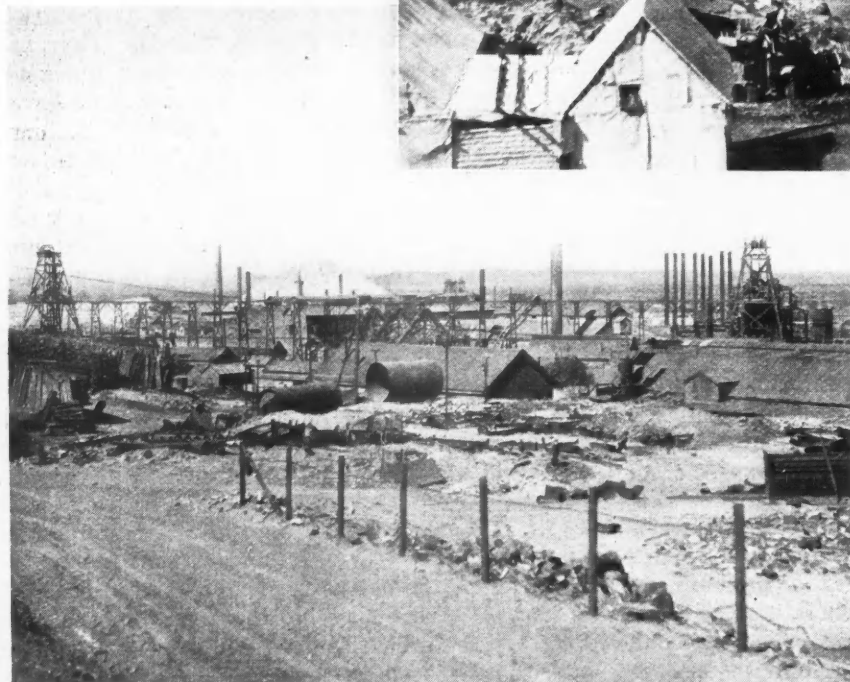
The probable mineral resources of Africa are enormous and have hardly been scratched. They are not confined to Katanga copper, Kimberley diamonds, or to Rand gold. Discoveries of other minerals have been most encouraging—platinum, asbestos, radium and fluor spar come to mind. But the development expense of new enterprises is, nevertheless, enormous; and large amounts of money must be spent. The history of Tanganyika Concessions may be cited as an example; it has been said that shareholders in this undertaking need to be blessed with patience and a long purse. Though formed in January, 1899, a quarter of a century ago, the common stockholders have yet to receive a dividend, and demands for additional capital are routine occurrences. Even now, additional money is required to enable Tanganyika to take up its proportion of the new stock and debentures of Union Minière; to complete the 650 miles of the Benguela railway, of which it owns 90 per cent, and by which a better outlet for copper will be provided; and to pay current bills. Plainly, rich and extensive though the mineral deposits in central Africa may be, those who in the end will profit by their development will have paid the price, and merited the increment.

At Kalgoorlie, Western Australia



At side—Mine plants of the Golden Horseshoe (left) and the Great Boulder Proprietary (right) companies

Right—A tailings dump—the result of many years of operation.



At side — View southwest from Associated mine. Perseverance shaft at right.

The Ruhr Iron and Steel Industry Under the Dawes Plan*

A Sketch of the Situation Resulting from Recent Developments in the Relations Between Germany and France

By C. K. Leith

University of Wisconsin, Madison, Wis.



C. K. Leith

THE Ruhr district of western Germany is the nucleus of the great European iron and steel industry, which extends into Belgium, Luxemburg, and northeastern France (including Lorraine). Though the industry transcends national boundaries, it is nevertheless essentially a commercial unit — one of the three great iron and steel units of the world, ranking second only to that of the United States and sur-

passing that of England. As the industrial hub of Europe, its control is of great political consequence, both for peace and war. Its growth having been confined to a few decades, historic precedents cannot play a large rôle in the settlement of the political problems involved in its operation. The industry cannot be divided geographically into self-contained parts, because the parts are supplementary. The history of the industry reflects increasingly strong tendencies for commercial and political unification, due to a variety of causes, including the complementary relationships not only of the coal and iron-ore deposits, but those of the blast furnaces, steel plants, and the numerous finishing plants built up around them; increasing difficulties involved in dividing political and commercial control which hamper the industry in world competition; the natural tendency of such a business, with increasing size, to lay more stress upon possession of the raw materials, a tendency which can be seen the world over in the iron and steel business; and, finally, the growing recognition of the political and military power which will be conferred on the country which succeeds in dominating this industry.

With the acquisition of the Lorraine iron ores, blast furnaces, and steel plants, as a result of the war, France became active in the rehabilitation and consolidation of the part of the industry which it controlled. Development was slow and halting, but in 1924 the French production was surpassed only by the United States. Capital flowed into the industry from French sources. Exchange conditions were favorable for export. The French iron and steel products had an outlet into Germany without tariffs, under the provisions of the Versailles treaty. The German part of the industry, on the other hand, was in a large part paralyzed by the French occupation of the Ruhr and the financial condition of Germany.

With the incidence of the Dawes plan there came a rather dramatic change in the situation. The Dawes plan practically required the withdrawal of the French from the Ruhr, so that it might earn its large part of reparations to be paid by Germany. The change in government in France from the conservative Poincaré to the radical Herriot meant a wavering of the purpose which had led to the occupation of the Ruhr. On Jan. 10, 1925, the tariff provisions under the treaty of Versailles expired, and Germany applied pre-war tariffs on imports of iron and steel products from France.

France now finds itself needing from Germany 70 per cent of the coke supply for its iron and steel industry, an outlet for surplus iron-ore production amounting to at least 4,000,000 tons per year, and especially an outlet for raw steel, which had ordinarily gone to the plants in the Ruhr for finishing. The exportable surplus of French iron and steel is at least 5,000,000 tons per year, of which a considerable part is not in shape for direct consumption, but must pass through finishing plants, which France does not possess. To build such additional plants would mean adding to the coke requirement and would require further immense capital outlay. It would require, also, further development of selling organizations and government co-operation to market this surplus in competition with the highly organized German industry.

As a result of this situation France has made strong efforts to reach some commercial agreement with Germany, but so far without success. In these negotiations the Germans seem to have the stronger position. Germany has the coal, which, throughout the world, means more than the possession of the iron ore. For the time being, at least, the German iron and steel companies have made themselves practically independent of French iron ore by increasing their contracts for Swedish, Spanish, North African, and Newfoundland ores; recently, also, they have closed contracts for the delivery of ores from southern Russia. The imported ores are all of high grade, and have run up the furnace yields to higher figures than in the past.

The extensive use of scrap iron, particularly of war stock, has also diminished the requirement for French ore. During 1924 the requirement for French ore was so reduced that less than one-quarter of the pre-war amount was used, and this seems likely further to dwindle. The freedom from requirement of French iron ore may be only a temporary one, for the industry has been built up on the minette ores of this region, and in the long run the French ores are likely to prove the cheaper for Germany. Scrap supplies also will lessen. Germany has the hundreds of accessory plants involved in finishing raw steel for the market, including much of that produced by France. The furnaces and steel plants which were lost in Lorraine have been largely duplicated in the Ruhr, and for the time being the combined steel-producing capacity of the two nations is in excess of the market requirements. Advantage has been taken of the peculiar opportunities since

*Summary of a talk before a round-table section of the Council on Foreign Relations, New York, March 16, 1925.
See also: "The World Iron and Steel Situation in Its Bearing on the French Occupation of the Ruhr," by C. K. Leith: *Foreign Affairs*, Vol. 1, No. 4 (June '25), 1923, pp. 136-151.

the war to modernize the plants. Selling organizations have been highly developed, and co-ordinated with transportation companies and the government.

Germany is therefore asking large tariff concessions from France, in addition to conditions giving Germany a larger proportion of the market than France is disposed to grant. It is difficult to see, under the circumstances, how any arrangement can be made, on a purely commercial basis, which will not give Germany a preponderant position, or a position which will lead to preponderance. Of course extraneous factors, such as reparations, might cause the Germans to make concessions, but such a factor is not permanent. The course of exchange is likely also to affect the situation. Nevertheless, it seems clear that Germany under the protection of the Dawes plan, has actually or potentially won a dominance in the commercial control of this industry, with all the advantages, political and military, which this implies. As need for the unification of the industry seems likely to continue, it is perhaps a reasonable inference that Germany will in time resume its efforts to acquire in one way or other the needed parts of the industry which are now within the confines of France.

FACTORS WHICH CONTROL IRON AND STEEL

To offset the indicated loss of the commercial battle for control of the iron and steel industry, which would leave Europe's most powerful weapon for war and peace in German control, France apparently has only military and political moves to counter with. Among the more obvious possibilities are: (1) The continued occupation of the Ruhr, involving either the actual absorption or domination of the industry by French interests, or the demoralization of the industry if left in the hands of the Germans. This is probably the most certain basis for security, or predominance, but it would mean the overthrow of the Dawes plan, the surrender of immediate reparation payments, and would meet serious political difficulties both at home and abroad. Probably, therefore, it will not prove feasible. (2) France may continue military occupation of the Rhine, until it has been able to conclude an alliance with England, or, what may be the same in effect, to enter a triple alliance with England and Germany, for the maintenance of the present western boundary of Germany; or until the League of Nations becomes strong enough to insure this.

We may differ in our judgment as to the relative importance of economic, military, and political factors in determining the outcome, but a student of natural resources is likely to see the commercial control of the iron and steel industry of western Europe as an advantage which is likely to carry with it ultimate military and political supremacy.

French Mine Production Higher

The production of ores in France during 1924 increased, according to preliminary data, for all the principal items. New production records were registered for bauxite, potassium, arsenic, and lead and zinc ores. In spite of the production of 340,000 tons of bauxite, domestic refiners, who enjoyed a strong demand for aluminum during the year, complained of a shortage of this ore, as the increase in production of 35,000 tons as compared with 1923 was merely equivalent to the additional shipments abroad and imports were small.

New Dry at the Montreal Mine

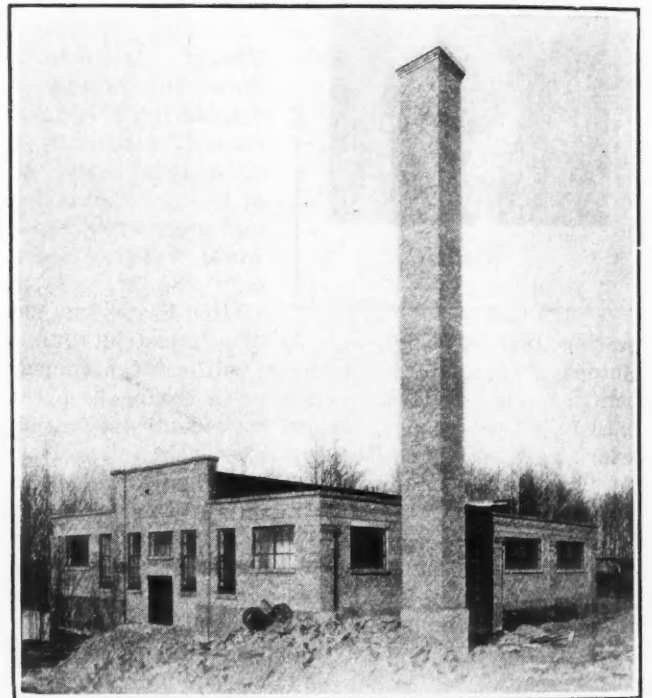
Separate Rooms for Mining and Street Clothes—Modern in Every Respect

By L. D. Stewart

Mechanical Department, Montreal Mining Co.

THE Montreal mine, operated by Oglebay, Norton & Co., agents, at Montreal, Wis., has recently completed a new dry for its No. 5 shaft. The design of the dry was prepared by the engineers of the Montreal Mining Co., and the building was erected and the engineering incidental to the construction was done by the Worden-Allen Co., of Chicago.

In building this dry there were several conditions



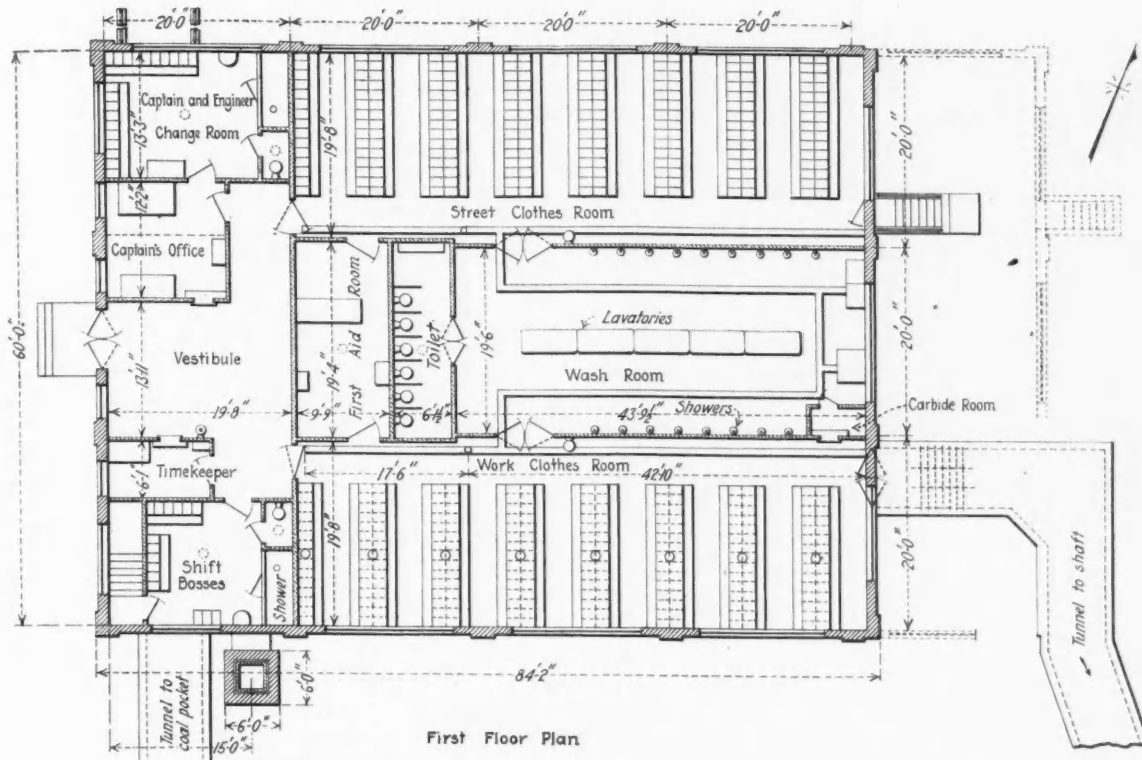
External appearance of new dry at the Montreal mine.

to be considered: sanitation, convenience, economy in operation and building, economy in heating, protection for the men going to and from the dry in cold weather and crossing railroad tracks, ample space in captains' quarters for captains, superintendents, engineers and visitors, eliminating fire hazard and the problem of enlarging the building without spoiling its effectiveness and also arranging that the men can get through the dry with the least possible loss of time.

ROOF RADIATES LITTLE HEAT

The building is of concrete, brick, and steel construction, with a Pyro-bar roof, which, in turn is covered with fireproof roofing. No wood is used in construction with the exception of the doors into the captains' and shift bosses' offices. Through the last winter it has been found that the Pyro-bar roof was an excellent investment, owing to the fact that very little heat was dissipated through the roof, and consequently the building was economical to heat.

Windows in the sides of the buildings are all above the tops of the lockers, allowing good lighting during the daylight hours. In addition, the central section also has windows on both sides, which afford ample lighting and ventilation for the wash room.

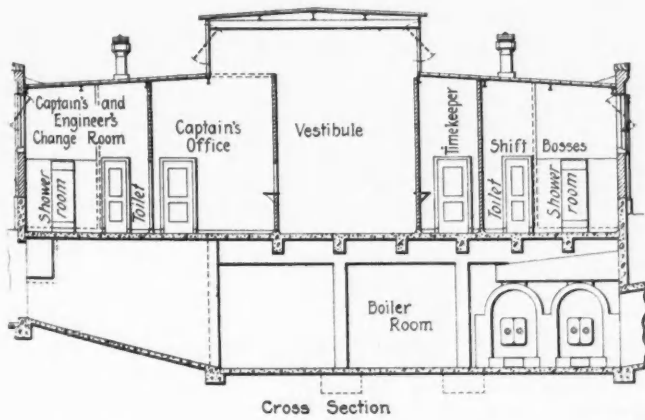


Plan of change house, showing arrangement of rooms and lockers.

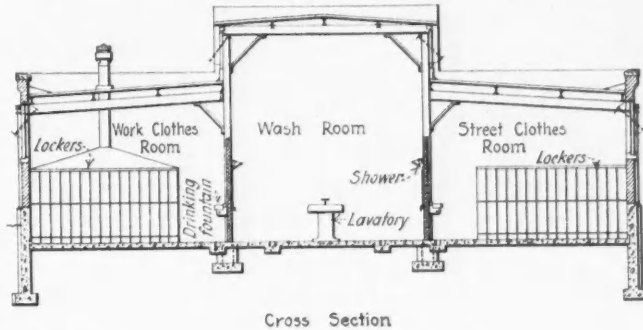
The building proper is 60x80 ft. and accommodates 450 men outside of the captains' and shift bosses' offices. Several features of this building are worthy of mention. There is ample room in the captain's quarters, a large vestibule, a time keeper's office, a first-aid room equipped with surgeon's laboratory, a

surgeon's cupboard, and a massage table to be used in washing injured men and also performing first-aid work. This room is well lighted, and operations could be carried on here if necessary.

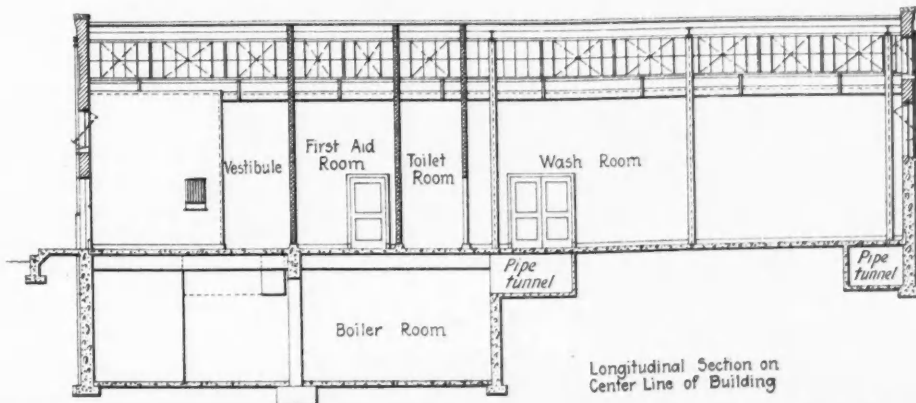
There are ample toilet facilities, and on the inside walls of the washroom there are showers on both sides,



Cross Section

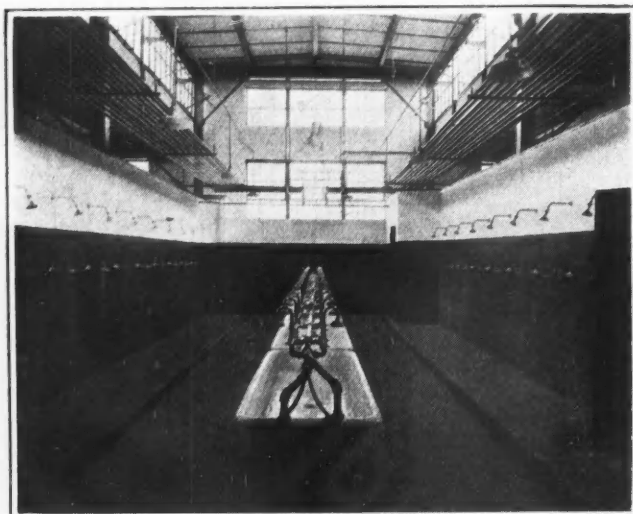


Cross Section



Longitudinal Section on Center Line of Building

Sectional views of change house, showing the construction and the efficient use of the space provided



A glimpse of the shower and wash rooms

together with the lavatories in the center of the room at which 30 men can wash at the same time.

In addition to the wash-room equipment, laundry tubs and a washing machine will be installed for the use of the men in washing their clothes. The dirty clothes and clean clothes are kept on opposite sides of the building. A man going to work enters the clean-clothes locker room and goes through the wash room to the dirty-clothes locker room, where he has a second locker in the same relative position, with the same number and using the same key, dresses, and goes out through the tunnel to the shaft. The process is reversed upon his coming from work.

Previous experience with trouble with water pipes and sewers had led to placing all such lines in this new building where they are easily accessible. Where it is necessary for any purpose to place pipes under the floor, a tunnel is provided so that such pipes may be easily reached.

Under each bank of dirty-clothes lockers there is a steam coil and over each bank of dirty-clothes lockers is a hood leading to a ventilator. The interior divisions of the dirty-clothes lockers are all perforated so as to allow a free circulation of air, resulting in conditions that compare favorably with those obtained by hanging clothes on a hook and hoisting them to the top of the building.

The tunnel to the shaft is extended from the back of the building a distance equal to another section of the building. This allows for ready expansion without interference with the operation of the dry and at the same time permits an addition to be made to the building without spoiling its appearance.

AMPLE HOT WATER PROVIDED

In the basement under the front part of the building is a boiler room that serves to heat the engine house, the dry, and the shaft house. In connection with this heating plant are the water heaters, two tanks of 500 gal. each, of $\frac{1}{2}$ -in. steel plate with $\frac{3}{4}$ -in. steel heads, which are also used for storing hot water. There are no coils in these tanks; the water is heated by exterior steam coils, automatically controlled by the temperature of the water. Additional units to these steam coils can be installed on the outside of the hot-water tanks to furnish larger quantities of hot water when the occasion arises. In addition to these steam heating coils,

there is a small stove for heating water that can be used should the steam be shut off. In connection with the supply of hot water from the tanks, there is a thermal regulator which can be set at such a temperature that no one in the dry can get water hot enough to scald or burn.

All wash-room drainage, except that from the toilets, runs through open ditches covered with iron grating to a drain in the basement, and thence into a settling basin of sufficient size to take care of any iron ore or heavy material that might clog the sewers. This settling basin can be cleaned very easily with a shovel.

The boilers are supplied with coal through a tunnel that runs out to a pocket under the railroad tracks, where coal is dumped from hopper-bottomed cars.

Though the footage per man in this type of building is probably considerably less than in most dries, in practice the men have ample room for changing clothes.

Foreign Magnesite Producers Form Export Syndicate

The magnesite producers of Austria, Czechoslovakia, and Hungary have formed an export sales syndicate centered upon the existing export organization of the Veitscher Magnesitwerke of Austria and similar to the syndicates previously formed by central European iron and steel plants, according to U. S. Assistant Trade Commissioner Elbert Baldwin, of Vienna. The syndicate began operations in February, and will handle 85 per cent of all export business on a quota basis, with the outstanding exception of sales to the United States. The remaining 15 per cent represents independent transactions with minor markets, such as the Baltic countries and Spain. Shipments consist almost entirely of dead-burned magnesite. It is intended mutually to lower export sales costs, and, eventually, lower prices may result; otherwise, the development is not expected to affect the present export business.

The syndicate, which has been formed for an initial period of three years, includes the magnesite-producing industries in Austria, Czechoslovakia, and Hungary—with the exception of the Herkuleswerke A. G. Kaschau, Czechoslovakia, and the Alpine Montangesellschaft A. G. Leoben, Austria—as well as certain magnesite brick works in these countries, Germany, and in England. Of the member companies three have headquarters in Austria, three in Czechoslovakia, two in Germany, and one is directed from England, and an agreement has been reached with Italian magnesite producers who have not officially joined the syndicate.

Although export sales to the United States are by far the most important, they will not be handled by the syndicate, in view of existing agreements, but will continue in their present direct channels between producers and American importers. Of the three countries represented, Austria has both the largest production and export. Its shipments in the first nine months of 1924 totaled 53,000 metric tons, valued at approximately \$1,000,000, in comparison with 70,000 tons during the corresponding period of 1923. Of the 1924 exports approximately 37,000 tons, or 70 per cent, was shipped to the United States. Austrian dead-burned magnesite at present commands an export price of \$16 per ton f.o.b. plant, if for shipment to the United States, and as high as \$20 per ton, if for shipment to European countries.

The Electric Shovel

Its Development—Problems and Features of Design—Advantages of Its Use

By D. J. Shelton

Assistant Chief Engineer, Marion Steam Shovel Co.,
Marion, Ohio



D. J. Shelton

THE first steam shovels built were of the friction type. On the shovel was mounted a steam engine equipped with a governor and a heavy flywheel to maintain constant speed throughout the various loads imposed upon it. The hoisting, swinging, crowding, and propelling motions were taken from this one unit by means of frictions. These shovels did their work well and pioneered the way for

future developments. They provided a more efficient method for handling materials, which made possible the promotion of greater projects. It was not long, however, until shovel designers saw the disadvantages of the constant-speed engine, with its heavy flywheel and attending frictions. It became apparent that the various motions of the machine should be subject to rapid acceleration, retardation, and reversal. The speed should be under the control of the operator, and inherently vary according to the load imposed. This applied in particular to the hoisting and crowding motions. It soon developed that a wide range of hoisting speeds was necessary, as no one fixed speed would meet all conditions. In heavy work the speed of the dipper should be low, and, in case an immovable object is encountered, it should come to rest with the entire bail pull exerted, and, upon being freed, immediately accelerate; and the dipper speed should be high when in light work or hoisting to dump.

With the constant-speed engine, it was impossible to obtain or approach the ideal operating characteristics just described. Some flexibility and a semblance of speed control were obtained by attempting to adjust the frictions so they would slip, but this adjustment was a delicate operation and not practicable. The inertia of the flywheel of the engine imposed great strains upon the machine when the dipper encountered an obstruction.

Independent drive eliminated all of these disadvantages, and ideal operating characteristics were obtained. It is standard practice among all manufacturers of steam shovels to provide a separate engine for each of the three motions; reversible double engines are universally used, the operator controlling

them by means of independent throttles and levers. Fig. 1 shows modern steam-shovel construction; compactness, simplicity, and the small number of working parts are readily noticeable. The operator has complete, independent control of each motion.

At present shovels may be divided into three general classes: (1) small revolving shovels carrying dippers from $\frac{3}{4}$ yd. to $1\frac{1}{4}$ yd.; (2) large revolving shovels with dipper capacities from 3 to 8 yd.; and (3) railroad-type shovels ranging from $\frac{3}{4}$ yd. to 6 yd. The railroad-type shovel was the first to be electrified, because at that time it was the only type developed and in general use.

Although the design of the railroad-type steam shovel was fairly well stabilized when the electric shovel was first introduced, it is worth noting that the first application of the electric motor followed the same principle as for the earlier steam shovel. It was necessary to have a large number of gears, shafts, frictions, and bearings, because, from one source of power, forward and reverse motions had to be provided for the crowding, swinging, and propelling, and a single motion for the hoisting, making seven motions in all. This machinery had to run continuously, which not only caused rapid wear, but increased power consumption. It was only a short time, however, until this single-motor method of operation was abandoned and independent drive considered and applied, for the same reasons as in the case of the steam shovel.

Real problems immediately presented themselves. There were many types of motors from which to choose. If a.c. motors were to be applied, the polyphase slip-ring type was, of course, the only choice. If d.c. motors were to be used, either the shunt-, compound- or series-wound must be chosen. It should be noted that at that time only constant voltage and rheostatic control was

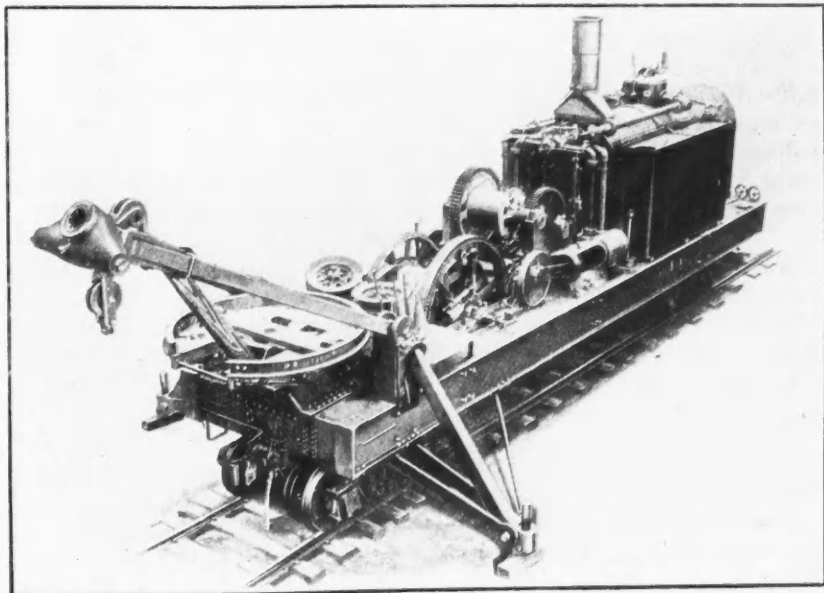


Fig. 1—A complete assembly, less cab and boom, of a modern railroad-type steam shovel

considered. The a.c. motor, as well as the shunt motor, has characteristics similar to the steam engine when equipped with a governor and flywheel; in other words, the speed is practically constant from no load to full load. With a wide-open throttle, the steam engine, such as used on shovels, has a speed torque curve similar to that shown in Fig. 2, and, generally speaking, this characteristic has always been considered ideal. With this in mind, one would naturally expect the series d.c. motor to be chosen.

From the very beginning of the development of the independently motored shovel, there has been a pronounced difference of opinion as to whether the d.c. or a.c. motor should be used. However, to analyze this phase of the problem is not the purpose of this article. It should be stated that a satisfactory electric shovel can be produced equipped with either a.c. or d.c. motor drive, although it is an established fact that a shovel equipped with d.c. motors and Ward-Leonard control will handle more yardage at less power cost than the same machine equipped with a.c. motors.

The speed torque characteristics of the series motor more nearly conform to that of the steam engine than any other type, and today there are approximately 800

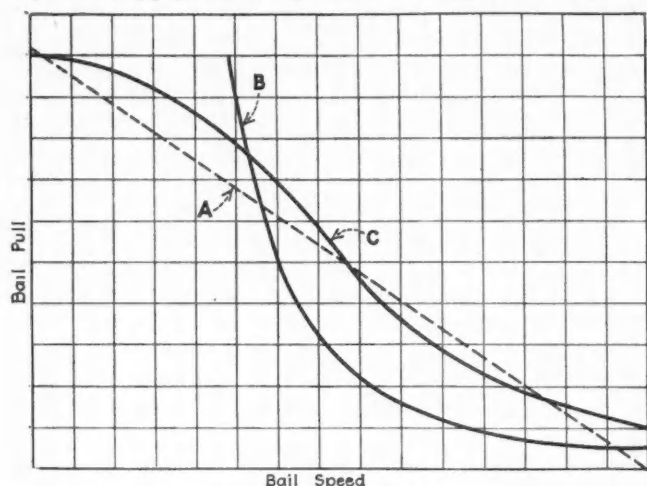


Fig. 2—A comparison of the inherent characteristics of a steam engine such as used on shovels (Curve A), of a series motor on constant voltage (Curve B), and of a series motor on variable voltage (Curve C).

mill-type series motors installed on electric shovels of various types and sizes. Until 1920 only constant voltage and rheostatic control had been considered, and many shovels are now operating satisfactorily with this type of equipment; however, in such installations certain features are not wholly satisfactory. In the first place, the practical application of the motor does not give the high speeds required at light loads, and the speeds at heavy loads are too high unless certain automatic features are provided in the control. To obtain the high speeds at light loads, it has been the practice to shunt out automatically a portion of the series field when the current to the motor drops to a predetermined value. To limit the current to a value which would develop the same maximum bail pull as in steam operation, and to cause the motor to come to rest under this maximum load, a jamming relay was provided. This relay was adjusted so that, when the maximum current input was reached, it automatically inserted into the motor circuit a resistance which held the current ap-

proximately to the maximum value while the motor was stalled.

On shovels of any considerable size, where rheostatic control is applied, it is the practice to use contactors, and, in addition to the features just described, it is necessary to have main line and accelerating contactors. Current limits are provided automatically to accelerate the motor, the circuits being so connected that the operator may select any step as a running point. Usually four to six steps of resistance are provided, and although the acceleration is generally smooth and the control fairly flexible, it does not favorably compare with steam in these respects. Another disadvantage of this type of control is the necessity of so many automatic devices. It is almost impossible to limit definitely and satisfactorily the current by the use of overload or automatic relays, such as are required when constant voltage is supplied. When alternating-current motors are applied, the use of slip-ring type motors and rheostatic control is the only practicable plan available, and this, of course, presents control problems similar to the d.c. when operating on constant voltage.

The most important step in the development of the electric shovel was made in 1920. Prior to that time, motors were applied and controlled by standard apparatus developed for general industrial equipment. In this year, however, a 300-ton large revolving shovel (of the type shown in Fig. 3) was developed, which was equipped with voltage control, generally called "Ward-Leonard control."

In Fig. 2 a comparison has been made of the inherent characteristics of a steam engine such as used on shovels (Curve A), of a series motor on constant voltage (Curve B), and of a series motor on variable voltage (Curve C). Curve C is the combined characteristic of the series motor and a generator having a volt ampere curve as shown in Fig. 4. It will be noted that Curve C has the same general shape as the steam Curve A. When the maximum current is flowing to the motor, the generator voltage has dropped to a value which will just maintain this maximum current with the motor stalled. This, of course, is the desired condition and it should be noted that the current can be limited definitely to a predetermined value. With this type of shovel equipment, three d.c. generators are provided, one each for the hoisting, swinging, and crowding motions. The three generators are driven by one motor, usually of the synchronous type.

An exciter is provided to excite the fields of the synchronous motor and the three generators. Each generator is provided with a separately excited field, a self-excited field, and a differentially wound series field. The self-excited fields were not provided for the first equipment, being added to later equipments to hold the voltage curve flatter throughout the various loads until near the maximum where it abruptly dropped. This produces higher speeds and better operating characteristics, especially in hoisting; however, when series motors are used for the swinging and crowding, it is a question whether the self-excited field is beneficial.

The shovel is operated by three master controllers which vary the resistance in series with the separately excited fields, making it possible to operate on reduced speeds with a minimum waste of energy. In addition to the equipment mentioned, a panel is provided for each of the three motions. On these panels are mounted

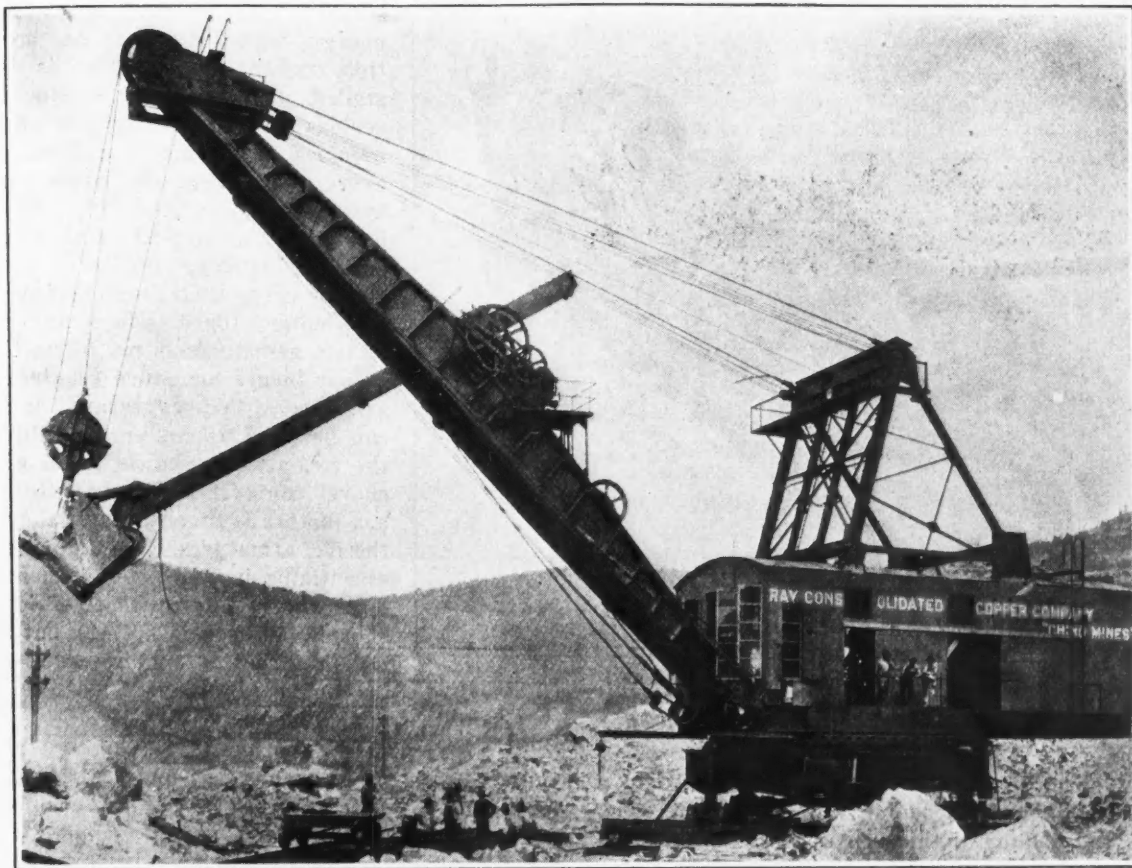


Fig. 3—Three hundred-ton revolving shovel equipped with Ward-Leonard voltage control

the few contactors required. The advantages of such control are immediately apparent. The circuits are simple. Proper acceleration is inherently obtained by means of the differential series field, as is the limiting of the current. These advantages are obtained without the use of automatic devices. The mechanical parts of the shovel are protected, and its operation is smoother than can otherwise be obtained.

Until recently, series motors were used for all three motions, and they proved very satisfactory; however, in June of 1924 a 3½-yd. railway-type shovel was put into operation, equipped with shunt motors on the crowding and swinging. Shunt motors operating on a constant voltage should never be considered, but when connected to a generator having a voltage characteristic as has been described, the conditions immediately change, because the speed torque curve then assumes, in general, the desired shape. The shunt fields are excited from the exciter circuit. The wiring is very simple, no contactors being required. For shovels using Ward-Leonard control and a drooping voltage characteristic, the shunt motor is the correct application for the swinging and crowding, and should be seriously considered for the hoisting when regenerative lowering of the dipper is used.

Fig. 5 shows the machinery of the 3½ yd. shovel already mentioned, and Fig. 6 shows the same shovel at work in a quarry. In comparing Fig. 1 and Fig. 5, the similarity should be noted. The synchronous motor and the three generators are located at the rear, as is the boiler on the steam machine. The rugged mill-type motors for the hoisting and swinging are in the same location as the steam engines; the drums and much of the shafting are interchangeable. It should be noted

that only knife switches and fuses are mounted on the control panels, the fuses to protect the control circuits and the switches to be opened only when the shovel is not in operation. Contactors and automatic devices are completely eliminated.

The electrification of small revolving shovels presents certain problems not found with the larger types. With this type there has been a tendency to return to the use of frictions. Fig. 7 shows the machinery required for one of the early-type friction machines. Development has proved that three-motor independent drive is just as essential on small revolving shovels as on the larger sizes for which no manufacturer now considers frictions. On small revolving shovels the space is limited, of course, and first cost must be seriously considered. A successful solution to this problem has been the development of the three-motor shovel in which each motion is independently driven by a series d.c. motor. In practically all cases a.c. power is supplied to

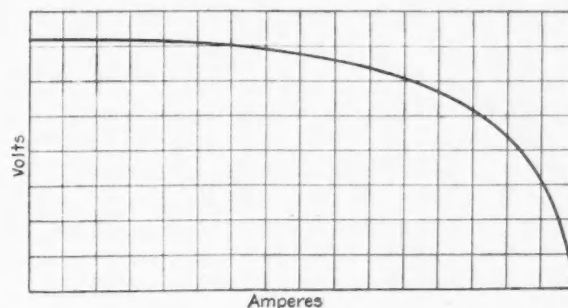


Fig. 4—Volt-ampere curve of a generator which with the series motor referred to has the combined characteristic shown in Fig. 2

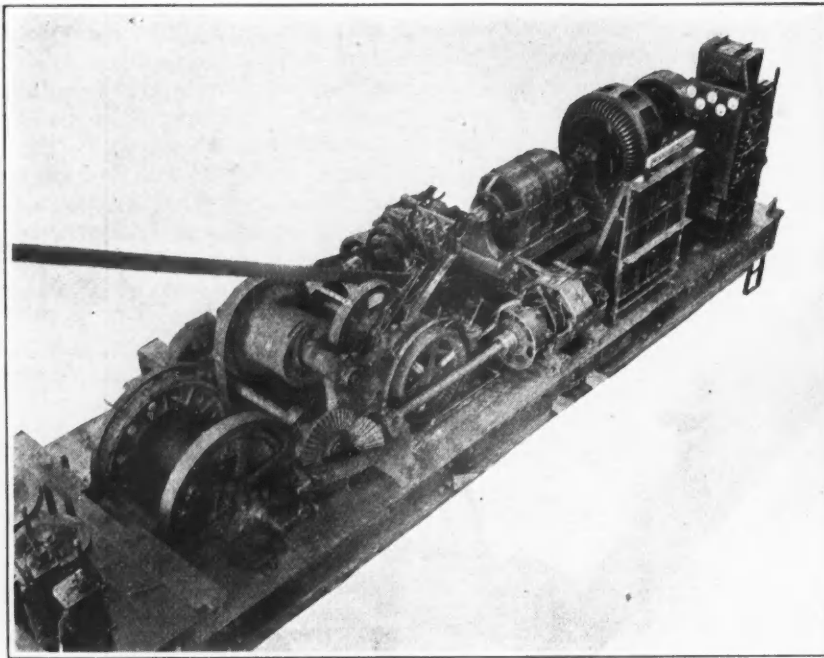


Fig. 5—Machinery of 3 1/2-yd. railway-type shovel equipped with shunt motors on crowding and swinging

the shovel, so an a.c. motor is directly connected to a d.c. generator having a drooping voltage characteristic. The light load voltage of this generator is high, and as the load is increased, the voltage decreases. The series motors are controlled by drum controllers and resistance, and protected against extreme loads by resistance automatically inserted in the line; however, the automatic feature is seldom needed, on account of the extreme flexibility obtained by combining the series motor and generator characteristics. A shovel thus equipped approaches the operation of one equipped with voltage control. The peaks are reduced, and smoothness and flexibility are obtained.

For railway and large revolving shovels, Ward-Leonard or voltage control is the correct application. The power input per cubic yard is less and the peaks are not as great when Ward-Leonard control with a drooping characteristic is used. When operating on constant voltage, the power input increases in a straight line, and the maximum occurs when the maximum current is flowing; at this point, the dipper is stalled and no work is being done. On the other hand when operating on variable voltage, the maximum occurs when the shovel is doing the most work, and, when the stalling point is reached, the input has dropped to a minimum. When Ward-Leonard control is used, power is generated only as it is required; consequently, the losses are a minimum.

The d.c. motor and Ward-Leonard control with drooping voltage characteristic is ideal equipment for electric shovel drive, because the shovel is under absolute control of the operator at all loads and has an inherent flexibility which, practically speaking, cannot be obtained when d.c. motors are applied on constant voltage or when a.c. motors are used. Even on the smaller shovels, a marked increase in speed, flexibility, and output is noted, because the generator voltage varies with the load; and the shovel structure is protected against severe shocks by this cushioning effect.

The power required to accelerate and retard the

steam engine is small, as is the stored energy when running; on account of this, when the dipper is suddenly stalled, the resulting strains are not serious. With the electric shovel this becomes a serious problem, as the energy stored in the armatures tends to carry them on after the dipper has been stalled. Armatures should be small in diameter, and on the larger-size shovels it has been found desirable to use two motors for hoisting, as the inertia of two armatures is much less than that of one larger armature required for the same duty. The necessarily large rotor can be cited as one serious objection to the a.c. motor, because for a given size shovel the inertia of the rotors of the a.c. motors is much greater than that of the d.c. armatures. The induction motor essentially has a poor efficiency when operating in intermittent service, and as shovel operation is nothing but acceleration, retardation, and reversal, this type of motor is placed at a decided disadvantage.

In addition to the motors and their control, much attention has been paid to refinements in developing electric shovels. An air compressor is included in the equipment to supply compressed air for operating the ram on the hoisting-drum friction band. On the larger shovels, each motion is supplied with a lock brake, which assists in retardation, and then holds the load after the power has been shut off. These brakes are set by springs and released by air pressure. They act smoothly, and their operation is made automatic by means of a magnetically operated air valve controlled from the master controller.

REVOLVING ELECTRIC SHOVELS REQUIRE ONLY ONE OPERATOR

On revolving electric shovels of all sizes it is the practice to use only one operator, the craneman being eliminated. The empty dipper on the large revolving shovels is lowered on regenerative braking, approximately 175 kw. being generated during the lowering operation. This not only eliminates the burning of brake bands, but makes the operation of the shovel easier.

The electric shovel is firmly established, and prejudice is being gradually overcome. The steam shovel, of

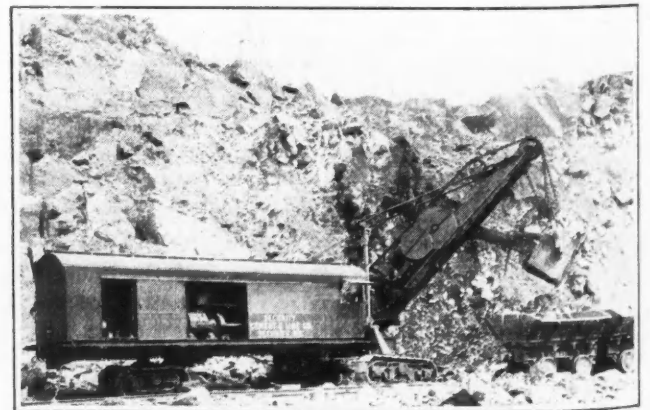


Fig. 6—A 3 1/2-yd. railway-type shovel at work in a quarry

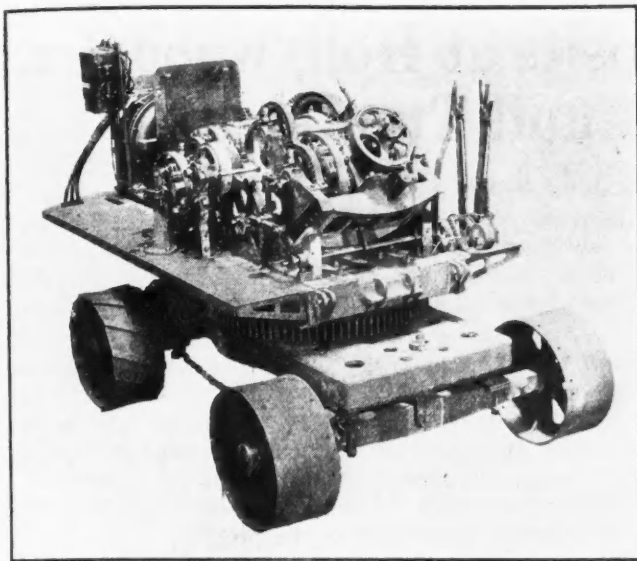


Fig. 7—This view shows the machinery required for a one-motor friction-type electric shovel

Superficial Copper Deposits

How They Are Formed and What They Teach

By Walter Harvey Weed

Mining Geologist, Tuckahoe, N. Y.

COPPER-BEARING CONGLOMERATES and other deposits carrying chrysocolla, copper pitch, and other oxidized copper mineral occur at numerous localities on this continent, and at a few places are profitably worked. Their manner of occurrence clearly indicates their surficial character, and the gravel deposits are sometimes erroneously spoken of as copper placers. In general, these deposits show a close connection with pyritic deposits, usually secondary disseminated copper deposits, whose weathering has furnished the copper-bearing waters cementing the gravel or metallizing the related impregnation deposits quite different in manner of occurrence but of similar genesis.

EXAMPLE OF THE OCCURRENCE

Copper-bearing gravels are mined at Ray, at Copper Butte, near Ray; at the Commercial mine (Phelps Dodge corporation), in Copper Basin, near Prescott, Ariz., and occur sparingly at Cananea and near Cumpas, Sonora, Mexico; at Copper Creek (on Bagdad Copper Co. ground in Arizona), and in numerous other places where pyritic deposits are undergoing weathering and erosion.

Though simple in genesis and of no very great economic importance, they are particularly interesting because they indicate a similar manner of formation for the ores of the Live Oak and Keystone veins at Miami and the deposits of chrysocolla and manganese copper pitch mined at the Black Warrior mine, Miami, Ariz., at Jerome, and at the Ray Hercules mine, at Ray, Ariz., the Bullwhacker and Butte-Duluth properties at Butte, Mont., and less important deposits at other widely scattered localities, from all of which ores have been shipped.

The copper-bearing gravel deposits all occur near disseminated copper deposits that are in porphyry or schist, and the copper occurs mainly as a cement binding the boulders and pebbles, though there is also an im-

course, still predominates, but transmission lines are being rapidly extended and power is becoming available at reasonable rates in practically all localities, so it is reasonable to assume the development of an increasingly large field for electric shovels.

Two pounds of coal will generate and deliver to an electric shovel enough electric power to handle one cubic yard of material. The steam shovel requires 6 lb. of coal. The electric shovel ordinarily requires 40 per cent fewer man-hours per shift than the steam shovel. The percentage of actual operating time should be greater for the electric shovel, especially where fuel and water problems are difficult of solution, and when operations must be carried on in freezing winter weather.

The initial cost of an electric shovel is greater than that of the steam shovel, and in most cases the additional expenditure can be justified, but before applying an electric shovel to an operation, the reliability of the power supply should be assured, and the rate carefully considered. Generally speaking, these are the deciding factors.

pregnation of the more porous or permeable rock types and probably some chemical replacement. At every place seen by me, cupriferous material is much less abundant than a rusty iron-bearing gravel, which carries no copper but is quite similar, save that limonite forms the cementing matrix.

PHENOMENON VISIBLE IN SOME CASES

The copper of these ores occurs largely as chrysocolla, either pure or mixed with oxides of iron and manganese. A common form is the dense lustrous black material called copper pitch, which is usually supposed to be black oxide of copper, but is largely the mixture just noted of chrysocolla, manganese oxide, iron oxide, and black oxide of copper (tenorite). Cuprite often occurs in streaks and nodular masses, and both azurite and malachite are sometimes found. Much of the black manganese ore carrying from 3 to 8 per cent copper, shows no green material whatever. The accompanying limonite cement rock is usually barren of copper.

The formation of such deposits has been observed to be taking place in small amount at various localities. The clear waters issuing from an old tunnel of the Live Oak mine, near Miami, became flocculent with green silicate of copper at a distance of 100 ft. or so from the tunnel as a result of rapid oxidation as the solution flowed over the creek bed. This material, gathered and analyzed, contained 18 per cent copper, the remainder being hydrated silica, the substance being evidently a mixture of chrysocolla and hydrous silica. Similar material was found in the drainage below the tailings dam at Cananea, Sonora, but, being washed down by every flood, it does not remain long. Great banks and beds of the iron cement gravel also occur at Cananea, over the mountain and at La Verde Camp, near Cumpas, Sonora, where pyritic deposits form a strongly acid iron-bearing water which on further oxidation cements the creek gravels with limonite.

The occurrence of such deposits has often led to costly and ill advised deep exploration work, which of course failed to find the source of the ore. The moral is, employ a geologist before, not after, doing the underground work.

Amphibole Asbestos Deposits at Hollywood, Ga.; Their Development and Treatment

*Important Domestic Supply May Result—James
Wet Process Makes Superior Product*

By L. B. Reifsneider

General Manager, Asbestos Mining & Manufacturing Company,
Hollywood, Ga.

THE EXISTENCE of several large deposits of mass fiber amphibole asbestos in Habersham, White, and Rabun counties, Ga., has been known for a number of years. United States Government geologists, state geologists, and others who examined these deposits generally agreed that, with one or two exceptions, the deposits were not of great commercial value, as the ores were too hard to be treated successfully by the ordinary means of fiberization applied to the Canadian fibers.

The largest two deposits so far developed are the Sal Mountain mine, on the slope of that mountain, a few miles from Asbestos station, on the Gainesville & Northwestern R.R., and now worked out and abandoned, and the deposit at Hollywood, Ga., about 5 miles northwest of Clarkesville, the county seat of Habersham County, on the Tallulah Falls R.R., which deposit is now being developed.

The Hollywood deposit has been known for many years. The Indians who formerly occupied this part of the state made use of the soft fibrous rock in making pottery, mortars, and pestles, many pieces of broken pottery and imperfectly formed utensils being found in the quarry operations today. The natives of the surrounding farms and villages frequently obtained the back stones and hearths for fireplaces from these deposits.

The first effort to develop the property for the production of fiber was made twenty-four years ago, when a substantial mill building was constructed and a quarry opened on a large outcropping on the slope of the hill within a few hundred feet of the mill. The mill is directly on the border of the railroad right-of-way.

The ore from this outcropping was soft and easily milled. Operations were carried on for several years before financial difficulties developed, so the property changed hands and then lay idle for some time. Several unsuccessful attempts seem to have been made to operate, and it was resold a number of times. About 1916-17 the property operated steadily, and seems to have prospered until the outbreak of the war caused a curtailment of the car service, so a shut-down was necessary although orders for over thirty cars of material were on hand.

At this time a considerable foreign trade with England, France, Germany, and the West Indies had been established, and the material was in good demand for heat insulation and for use in flooring and plastering. It had been used successfully in flooring and constructing several large buildings in Chicago, among them the Y.M.C.A. and Sears-Roebuck buildings and also in buildings in Philadelphia. The European countries used it mainly in heat insulation and cement work. In the West Indies it was mainly employed in flooring sugar mills, to which use it seemed particularly

adapted. All this trade of course was stopped by the war.

No accurate record of the production up to this period is available, but the quarry openings indicate the shipment of several thousand tons.

Early in 1923 a number of men from Nashville, Tenn., became interested in the property. A company called the Asbestos Mining & Manufacturing Co. was organized and incorporated in Georgia under a very liberal charter. W. B. Shelton, of Nashville, was elected president, J. Holland Wright, secretary, and Abb Landis, treasurer and managing director. Mr. Shelton took charge, and he directed the work of clearing the quarries, repairing buildings and machinery, constructing roads, and erecting a small office and other necessary buildings.

Milling operations began in June, 1923, but the quality of fiber produced by the old equipment, although fairly satisfactory for some purposes, did not fill the requirements necessary to meet the competition of the Canadian short fibers, and experimental work looking to improved milling practice was at once begun.

After considerable experimentation it was decided to install a modified form of the Jay-Bee mill, manufactured by the Bossert Corporation, of Utica, New York. A system of air separation, with selective suction, in series with bell separators, was worked out and installed to remove the small particles of grit and unfiberized particles from the product. In November, 1923, the company decided to employ L. B. Reifsneider, a man of wide mining and quarry experience, as superintendent, and the active management of operations was put in his charge, with instructions to work out a definite plan of operations.

From surface indications and the old quarry workings, it had been estimated that 40,000 tons of ore were in sight. Conservative financing limited the expenditure of capital to a figure proportionate to recoverable values. A discouraging situation had also developed in the disorganized condition of markets brought about by the declared insolvency of several large Canadian asbestos producers, whose stocks of both long and short fibers had been thrown on the market at prices in many instances 50 per cent or more below the cost of production. Users in the United States took advantage of these conditions and supplied themselves for many months in advance, so the demand for short-fiber materials had disappeared. Realizing these conditions, the company decided to suspend sales efforts until marketing conditions became more nearly normal and, in the meantime, instituted a campaign of exploration and experimental work looking to the development of ore resources and to further improvement in the quality of product. It was also desirable to develop the qualities of the Georgia fibers compared

with the Canadian fibers of equal grades. The scarcity of amphibole fibers on the market and the wide use of, and familiarity with, the Canadian chrysotile, tended to cause the users to prefer the latter, especially as the comparative qualities of the amphibole were unknown.

The exploratory campaign was greatly simplified by local conditions. The company's holdings in Hollywood consist of 18.9 acres in fee simple, and mineral rights for all minerals except gold upon the adjoining plot of 50 acres. On the fee simple holdings, paralleling the railroad, is a low ridge or hogback nearly 2,600 ft. long. This ridge rises to an elevation of from 20 to 60 ft. above the mill floor. For a total length of over 1,150 ft. along the hogback, with a strike of N. 20 deg. E., is a series of boulders and outcroppings from 20 to 150 ft. wide.

A base line was established, paralleling the line of strike, and a series of cross-section lines turned off at 50-ft. intervals. On the cross-section lines the most favorable locations were selected and a series of pits and trenches sunk until solid ore or the country rock was reached; the surface outlines of the ore were established from these lines. Depths considered in making the estimates were taken either from the old quarry openings or, where these were non-existent, from 45-ft. or 50-ft. prospect pits sunk in the orebodies. Many of the outcroppings are above the surface, and the greatest depth of overburden was 7 ft., with an average of perhaps 18 in. for the entire body.

FOUR OREBODIES FOUND

This system of pits and trenches established the existence of three apparently distinct orebodies, roughly in echelon, about 1,200 ft. long, of unequal size and divided one from the other by intrusions of quartzite or pegmatite dikes. A fourth orebody lay parallel to the center one of the three in echelon and was separated from it by a pegmatite dike. The various shafts and quarry openings establish a depth of 50 ft., with an unknown extension to greater depth.

The amount of alteration from the original rock to the fibrous form varies considerably. It has been greatest on the footwall and the hanging wall, where in some places it seems to have reached the fibrous soapstone or talcose state. Progressing toward the center of the mass the ore becomes harder and less fibrous unless it has been cut by cracks or crevices allowing the surface to penetrate, in which case the alteration is more complete. In all the quarry openings, the existence of a hard core or center of unaltered rock has been established, ranging from a few inches to several feet, the thickness increasing with depth below the surface or as water level is approached.

The ore varies greatly in color. On the surfaces where alteration has been greatest and surface waters have made most penetration the color is yellowish buff, owing to the deposition of iron oxides. This color changes gradually, until near the center the color is gray or bluish white, the hard core in the center presenting a greenish-gray appearance.

AMPLE TONNAGE AVAILABLE

Professor Glenn, of Vanderbilt University, who recently examined the property, says he would expect all of the fiber to be in the unaltered state at or near water level. This would give a recoverable depth of 60 ft. in the largest body and from 30 to 50 ft. in the

three smaller bodies. Should the recoverable fiber extend only to the 30-ft. depth, the recovery would be about 135,000 tons; this would be increased 4,500 tons for each additional foot of depth. Experimental work indicates a greater value in the unaltered material than in the fiber itself.

The trenches on the asbestos deposits establish the existence of a highly micaceous pegmatite dike paralleling and forming the footwall of two of the orebodies for a distance of more than 800 ft. Several shafts have been sunk on this dike, each of which, after passing through an overburden of micaceous red clay 12 to 20 ft. thick, penetrates what is apparently a continuous body of high-grade mica-kaolin with feldspar and quartz. Careful mill tests from mine-run samples show 25 per cent high-grade kaolin, 20 per cent mica, and the remainder quartz and feldspar, all of commercial value. Exploration and experimental work on the mica-kaolin are still in progress.

NEW METHOD OF WET TREATMENT DEVELOPED BY U. S. JAMES

While the exploratory work was being carried forward, samples of the asbestos ore were submitted to U. S. James, of the James Ore Concentrator Co., of Newark, N. J. Mr. James had for several years been advocating the treatment of the short fiber asbestos ores by the wet process—gravity concentration—and had, in fact, perfected a process by which the work could be done successfully. The tests were run with the James equipment and were an unqualified success from the start. Not only was the fiber yield increased to 73 per cent, but the waste and grit were completely removed, leaving a soft, silky, resilient fiber. The sand was left in such condition as to be usable as a by-product, and the magnetite and chromite, which form the only metallic impurities in the ore, are also recovered as a separate product.

The ore is first reduced to minus $\frac{3}{4}$ -in. round-hole mesh by Gates and Tel-smith crushers. It is then sent over a 6-mm. screen, the undersize going directly to a James automatic ore feeder and the oversize to a set of squeezing rolls with a 6-mm. opening. The material from the rolls is combined with the undersize from the screen at the ore feeder and is fed, at the rate of 1,200 lb. per hour per table, to a Hardinge ball mill.

MILLING IS SIMPLE AND EFFICIENT

As the feed enters the ball mill it is caught by a heavy flow of water. The ball load in the mill is light, about 200 lb. of small-diameter balls being used in a 3-ft. Hardinge mill. The fibers in the rock, having already been loosened by the squeezing action in the crushers, are very quickly released by the hammering action of the balls, and owing to the cellular structure and the heavy flow of water are quickly reduced to a size that allows them to be floated out of the mill to a concentrating table. On the table the usual positions of concentrate and tailing in wet concentration are reversed. The fiber, being light, is rapidly carried over the riffles by the heavy flow of water and discharged over the side of the table. The usual middling cut, consisting in this case of small bundles of undivided fibers, is taken off the table at the usual place. The sand is cut in two parts, that from the middle of the table being the regular commercial asbestos sand. The sand discharged from the upper riffles contains small amounts of magnetite and chromite.

The middling cut is returned to the ball mill for regrinding and the fiber discharged over the side of the table is taken to settling tanks for dewatering. The pulp from the settling tanks is pumped by diaphragm pumps to Oliver filters, where about 60 per cent of the moisture content is removed; it is difficult to reduce the moisture content further by mechanical means, and drying from this stage to the finished product must be by heat.

Several forms of drier have been under consideration. Steam will probably be used as a heating medium, utilizing both live and exhaust steam. The exact form of drier has not yet been decided upon, although the Lowden drier is indicated in the flow sheet.

The material discharged from the drier, owing to its fibrous nature and self-binding qualities, is slightly lumpy, so a machine is being devised for beating up the lumps before the product is delivered to the elevator which delivers it into the storage bins ready for sacking. A simple sacker in which the material is compressed into 100-lb. bags by a feed-screw conveyor completes the cycle of operations.

The secret of the success of the James process lies in the slow multiple stage reduction, with a squeezing action to loosen the fibers until the ball mill is reached. The mill has a light load of balls, and the feed enters the mill with an unusually heavy flow of water. The cellular structure of the fiber makes it easily floated, and it can readily be seen that as soon as a particle of fiber is loosened it is picked up by the water and carried to the tables.

ADVANTAGES OF PROPOSED PROCESS

Among several advantages produced in the fiber by the James process the following are the most outstanding:

Entire freedom from grit and metallic substances.

The washing process imparts a resilience to the fiber which is entirely absent in that from the dry process, with consequent better covering capacity and insulation properties.

Natural acid-resistant qualities are enhanced by the removal of the iron and chromite, thus making a better acid-filtering medium.

Self-binding qualities make unnecessary the use of other substances as a binder when applying the fiber for heat insulation on boilers and steam pipes.

Non-shrinking qualities make it better for use in flooring, plasters, and similar applications.

The James process may revolutionize the treatment of short-fiber asbestos deposits and it will make available a domestic supply of this grade of material.

FURTHER RESEARCH NOW IN PROGRESS

Experimentation on the separation of the mica-kaolin-feldspar-quartz into their component parts is now in progress in the James laboratory. It has been found that by using the same equipment employed in the wet treatment of asbestos, with the addition of several devices especially adapted for the purpose by Mr. James, a good recovery of all the valuable constituents of these deposits is obtained. Marked success in making complete separation of the mica and kaolin has been obtained, as the kaolin is recovered absolutely free from mica. The mica, even to 300-mesh size, is also recovered entirely free of the quartz and feldspar.

Working out an economic flow sheet for the treatment of both the asbestos and the mica-kaolin will be

completed as soon as the experiments are finished, and it is planned to go ahead with the erection of a plant as soon as the flow sheet is available and the final details are worked out.

While the foregoing experiments have been under way, a series of tests to determine the uses to which this class of fiber is adapted, and the comparative value with the Canadian fibers, has been made in the U. S. Bureau of Standards laboratory and in various other places. The fusion point of the Georgia fiber has been determined as slightly lower than that of the Canadian fibers. In resistance to acid and acid gases the Georgia fiber surpasses the other. In heat insulation, as applied to steam pipes and boilers, its greater resilience, self-binding, and non-shrinking qualities make it more effective. Much experimental work remains to be done, but it is believed that eventually it will be found that the various grades of the amphibole short fibers are as valuable as the Canadian product, if not superior to it.

Decrease in Production of Sulphur in 1924

The production of sulphur in the United States in 1924 dropped to 1,220,600 long tons from 2,036,097 long tons in 1923, a decrease of 40 per cent, according to figures compiled in the U. S. Geological Survey. The shipments also decreased, dropping from 1,618,841 long tons in 1923 to 1,537,400 long tons in 1924, a loss, however, of only 5 per cent. The shipments in 1924 were thus the second largest on record and for the first time since 1920 were greater than the production. The estimated value of the shipments in 1924 was \$25,000,000, compared with \$26,000,000 in 1923, at approximately the same rate per ton.

The producers' stocks in hand at the end of 1923 were approximately 3,000,000 tons. The stocks were depleted during 1924 by the surplus of shipments over production, and at the end of the year were approximately 2,700,000 tons. Stocks are still so large as to make improbable any material increase in the rate of production. About 300,000 tons (10 per cent) of the stocks in hand at the end of 1923 was shipped in 1924.

The exports of sulphur, or brimstone, from the United States in 1924, according to the Bureau of Foreign and Domestic Commerce, were 481,814 long tons, valued at \$7,786,254. The exports of refined and sublimed sulphur and of flowers of sulphur in 1924 were 2,329 long tons, valued at \$107,947, making the total exports of crude and refined sulphur during the year 484,143 tons, valued at \$7,894,201, compared with 474,475 tons, valued at \$7,216,107 in 1923.

The production of sulphur in Sicily, which averaged about 350,000 metric tons before the World War, dropped considerably during and after the war, owing largely to the increase in competition for European markets of sulphur mined in Texas and Louisiana. The exports from the United States increased from 89,221 long tons in 1913 to 487,969 long tons in 1922, and in 1924 they were 484,143 long tons. The agreement between the American producers and the Sicilian Sulphur Consortium in 1923, proportioning sulphur among the markets of the world, has probably benefited the Sicilian producers, as the production in Sicily increased from 137,648 metric tons in 1922 to 206,238 metric tons in 1923, and amounted to 115,045 metric tons during the first six months of 1924, a rate of about 230,000 metric tons for the year.

Geology of the Verde Central Mine

*A Study of the Possibilities of Finding New Orebodies
in This Property in the Jerome District of Arizona*

By J. L. Fearing, Jr., and P. C. Benedict

Geologists, Jerome, Ariz.

RECENT DEVELOPMENTS on the fourteenth level of the Verde Central mine doubtless have caused many to ask if the Verde district is to have a third producer. Although geological conditions preclude the chance for finding secondarily enriched bonanzas comparable to those of the United Verde Extension, except possibly in an unexplored area covered by post-mineral sedimentary rocks, and present indications do not promise primary orebodies of the magnitude of those at the United Verde, certainly no other prospect in the district has ever approached the possibilities for copper that exist at the Verde Central.

A little more than half a mile from the United Verde, and less than a mile from the United Verde Extension, are the workings of the Verde Central. The unpretentious sheet-iron buildings of the surface plant which greets the eye of the traveler entering Jerome are evidence of the purpose of the management to spend every dollar prospecting for ore rather than for "surface showings."

To obtain a scientific understanding of the Verde Central, it is necessary to consider first the general conditions existing in the district, more especially as manifest at the United Verde mine. The best paper on the geology of the Jerome district is that by L. E. Reber, Jr.¹ The geological column as established by him is as follows:

- Pre-Cambrian formations
 - 1. Yavapai schists.
 - a. "Greenstone" series.
 - b. Metamorphosed sediments.
 - 2. Quartz porphyry.
 - 3. Augite diorite.
 - 4. Andesite dikes.
- Palaeozoic formations
 - Sandstone, limestones, and shales.
- Cenozoic formations
 - 1. Tertiary basic lavas.
 - 2. Quaternary lake beds.

The distribution of these formations is shown on the accompanying map of the areal geology. Ore deposits are in no way connected with any rocks later than Pre-Cambrian in age, so it would be irrelevant to discuss the more recent divisions.

The oldest formation is the Yavapai schist series, probably Algonkian in age, which, in the Jerome district, may be divided into an older "greenstone" series and a younger metamorphosed sedimentary series. Locally, "greenstone" does not signify altered basic rock only, but is employed as a general term to include the oldest series of orthoschists, derived principally from extrusives and volcanic fragmentals. The younger series are known as the "bedded sedimentaries," and are the metamorphosed derivatives of shales, sandstones, and limestones. Intruded into the Yavapai schists is a quartz porphyry, a border phase of the main granite batholith that outcrops in the Bradshaw Quadrangle south of Jerome. In places, notably along its contact with the greenstone, which may be traced from the United Verde workings to the Verde Central, the porphyry is schistose. Palache and Jagger have

suggested² that the compression which resulted in this local schistosity might have taken place in still viscous portions. Next in the geological sequence is the United Verde augite diorite, which, in a general way, was intruded along the pre-existing contact of the quartz porphyry and Yavapai schists. Analogous masses of diorite are also found along the margins of the Bradshaw granite. The last of the Pre-Cambrian intrusives are andesite dikes.

The orebodies at the United Verde mine were formed by the replacement of schist by pyrite, quartz, and chalcopyrite, with lesser amounts of sphalerite, galena, specularite, tennantite, magnetite, arsenopyrite, bornite, and carbonates. The evidence of replacement is as follows:

1. Preservation of original schist structures.
2. The occurrence of gradational boundaries between schist and massive sulphides.
3. Unsupported residual schist masses having concordant orientation.
4. Irregularity of sulphide masses.
5. Absence of crustification.

The replacing solutions appear to have been centralized by the arch-shaped hanging wall of diorite. Besides schist, porphyry has been replaced sufficiently to make commercial bodies of ore. The orebodies consist in part of finely intergrown pyrite and chalcopyrite, with varying amounts of quartz, and in somewhat lesser part of schist areas which have been little affected by the early pyritic phase of the mineralization.

The deposits at Jerome are closely connected with Pre-Cambrian igneous activity. The hanging wall of diorite, which is generally unreplaced though highly altered for a few feet along the contact, bears evidence that the solutions came from below. The chronological sequence of events shows the close relationship of the ores to the igneous activity. Though the diorite is the latest intrusive previous to the formation of the ores, the widespread and intimate association of copper mineralization with porphyry leads to the conclusion that the ore-bearing solutions were related to the porphyry rather than to the diorite. In classifying the deposits as to genesis, there are many aspects suggesting intermediate depths and temperature, but the presence of specularite and especially magnetite indicates that higher pressures and temperatures must have existed, at least locally. The magnetite and specularite occur in patches abundantly intergrown with the sulphides, but make up an insignificant part of the bulk of the ore.

The Verde Central group was located in 1904 as the Verde King, and four comparatively short tunnels were driven. These workings were intended to prospect slips and contacts which, although they showed no gossan or mineralization of any kind at the surface, were believed to be favorable places. A small amount

¹1920, *Transactions*, A.I.M.E.

²U. S. Geological Survey, Bradshaw Mountains Folio, No. 126.

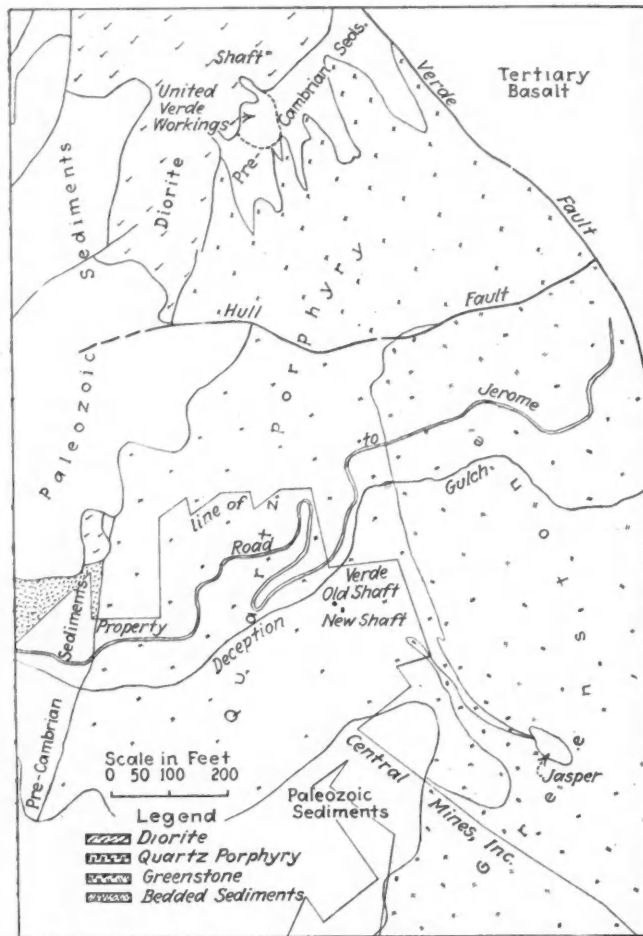


Fig. 1—Map showing surface geology of the Verde Central property and adjacent ground

of copper staining was shown up by this work, but the funds of the company were exhausted, and the death of the chief promoter precipitated the closing down of the property in 1907. C. T. Joslin, of Prescott, took over the holdings in April, 1916. He interested W. F. Staunton, who became president and general manager of Verde Central Mines, Incorporated, and under whose able guidance exploration work has been carried out since March, 1918. In December, 1918, T. H. Collins purchased \$50,000 worth of the Joslin stock to keep the wheels turning. On July 1, 1921, Calumet & Arizona took over an option on a large block of stock, and has provided all funds since that date. Last year the Calumet & Arizona obtained control, and Gordon R. Campbell became president of the Verde Central, while Mr. Staunton has remained in charge of operations as vice-president and general manager.

At the Verde Central mine the ancient Pre-Cambrian rocks are highly altered and sheared, making their positive identification difficult at all times. There are two principal rock types—namely, fine-grained quartz porphyry and coarse-grained quartz porphyry. The fine-grained porphyry, possibly a rhyolite, is believed to be a member of the old greenstone series which was intruded by the quartz porphyry, but its relationship to either of these systems has not been positively established. Nor is there sufficient evidence at hand to determine whether the fine-grained quartz porphyry (hereinafter designated "greenstone") is intrusive or extrusive, but the latter is believed to be the case. In appearance the greenstone and quartz

porphyry are similar, and their identification is especially difficult at contacts, because the quartz porphyry frequently tends to become finer grained and the greenstone more porphyritic. The groundmasses of these two rocks are completely altered to secondary quartz, chlorite, and sericite. Therefore the only criterion for separating them is the size and abundance of the quartz phenocrysts. The microscope gives little assistance in identification. Both rocks show quartz phenocrysts, usually surrounded by secondary growths of similarly oriented quartz, imbedded in a groundmass of fine-grained secondary quartz, with variable amounts of chlorite and sericite. Sericite sometimes forms pseudomorphs after feldspar, and occasionally residual masses of an acid plagioclase may be seen. Owing to their petrologic similarity, it is only after considerable practice and experience with these rocks that one can definitely locate their contacts, a matter of paramount importance in prospecting.

The accompanying somewhat generalized sections show the structural relationship of the greenstone and quartz porphyry in the Verde Central mine. Fig. 2, which is taken through the old incline shaft, may be regarded as a cross-section, while Fig. 3 is approximately at right angles to Fig. 2 and is longitudinal.

The importance of definitely establishing the greenstone-porphyry contacts at the Verde Central mine is based upon the fact that all mineralization is found near them. Indeed, mineralization is so characteristic of contacts that, except for oxidation products sometimes found along slips, it indicates a change of formation. Such is the case from top to bottom. On the 120 or tunnel level a little chalcocopyrite and some secondary minerals were found. On the 300 level a few thousand tons of low-grade primary ore has been opened up along the contact in a zone of schistose quartz porphyry. On the 600 and 800 levels a little mineralization is almost always present on the contacts, becoming important enough along the west margin of the main greenstone tongue on the 800 level (called the west contact) to form an orebody possibly 400 ft. long by 3 ft. in width that would average 3 per cent

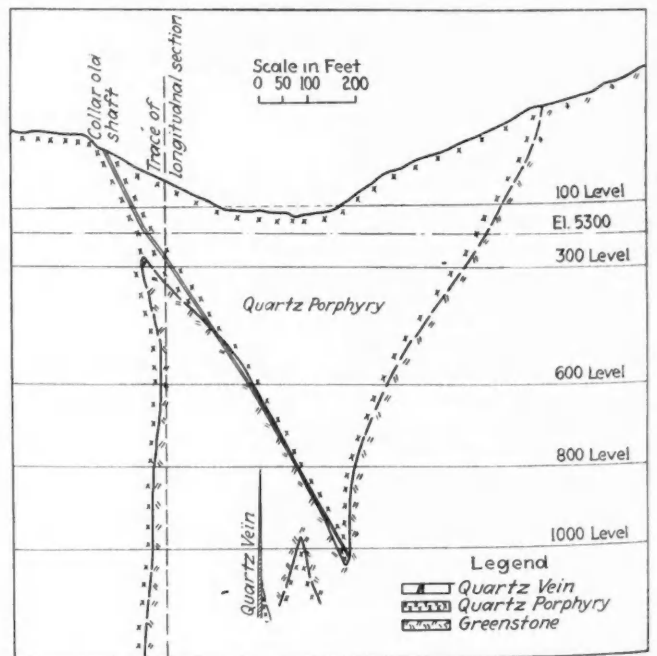


Fig. 2—Section through old shaft, Verde Central mine

copper. On the 1,000, or tenth, level (856.4 ft. below the collar of the new vertical shaft) this west contact is characterized by some primary mineralization along the entire length prospected, but that part which might be designated as ore is not nearly so long as it is on the level above. Very little work has been done on this contact on the fourteenth level (1,456.4 ft. below the collar), but conditions apparently are the same.

The ore minerals occurring along contacts characteristically replace a black schist, as at the United Verde mine. The black schist is for the most part derived from the greenstone, but the black chlorite, of which it is composed, has sometimes been developed in the porphyry, although the quartz phenocrysts have not been destroyed. The replacement of the greenstone by the black chlorite took place under conditions of dynamometamorphism. Generally speaking, the black schist is most perfectly developed along the quartz-porphyry contacts. The similar occurrence of ore minerals and black schist, combined with the facts that commercial ore is always found in the schist as a partial or complete replacement, and that typical black schist frequently carries some mineralization, speaks for the closely related origin of the two.

We have previously stated that all mineralization at the Verde Central is actually on or related to contacts between greenstone and quartz porphyry. Although the schist replacement ores on the tenth level were promising, the most important find was opened up in a quartz vein between the old shaft and this west contact. Until sufficient exploration work was accomplished, it seemed possible that this quartz mineralization with greenstone on both sides might not be a contact phenomenon. But 90 ft. in on the vein, and continuing for 70 ft. farther, quartz porphyry, representing the apex of a tongue hitherto unknown, was exposed. This so-called quartz vein differs from the usual type in that, although it contains considerable white bull-quartz, the major portion consists of a greenish-gray, fine-grained quartz representing a localized silicification of the greenstone.

A noteworthy characteristic of the quartz porphyry in the Jerome district is the occurrence of fine-grained quartz along its apophyses. Though the solutions which deposited the quartz of the Verde Central vein may have been guided somewhat by a minor slip to the east of which the mineralization lies, it is believed that the quartz represents hydrothermal contact activity apophysal to quartz porphyry rather than a definite fissure vein. In the mineralization of both the black schist and the quartz, the sulphides occur as lenses, veinlets, and disseminations, sometimes so numerous as to form relatively massive sulphides, which may show even no residue of replaced material. Some weeks ago work on the fourteenth level cut this same quartz vein 600 ft. deeper down and about 250 ft. north of the best ore on the tenth level. More important than the fact that the vein was 1 ft. wide here and ran 3 per cent is the proof that it persists with depth.

The accompanying map of the 1,000, or tenth, level of the Verde Central shows three tongues of quartz porphyry in addition to the main mass to the west. Two of these may represent the single tongue known on levels above, but the third, already referred to in explaining the occurrence of the quartz vein, is considered to be a generally favorable indication. To date, work on the fourteenth level has encountered no por-

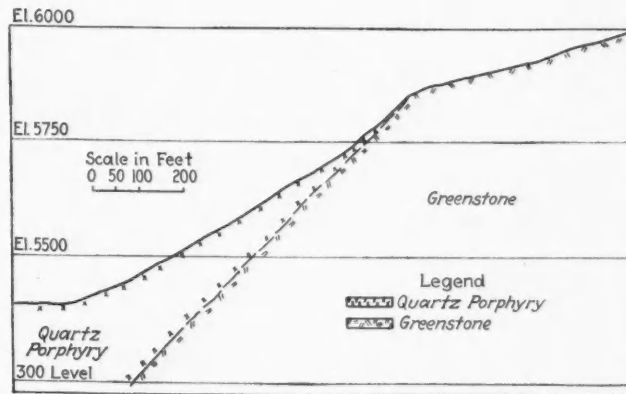


Fig. 3—Longitudinal section through Verde Central

phyry tongues, probably because their northward rake has carried them beyond the main crosscut which extends due east from the new shaft. Later work should include the exploration of possible areas of intimate interfingering of quartz porphyry and greenstone because of the fact that with such a condition the greenstone is most likely to be altered to the chloritic schist so amenable to ore deposition.

Too little is known about ore deposition at the Verde Central to make it possible to predict with certainty that a given porphyry tongue will have stoping ore apophysal to it, or that a given interfingering of porphyry and greenstone will form commercial bodies of chloritic schist ore, but enough has been learned to make it obvious that porphyry contacts are the most favorable loci for metallization. With the continuity of the quartz vein proven by the fourteenth level crosscut, it is reasonable to expect that further development will expose conditions favorable for commercial concentrations of ore along this vein and on other contacts.

Without imposing responsibility for the opinions expressed in this report, the writers wish to express their gratitude for valuable criticism and assistance to Dr. L. E. Reber, Jr., F. C. Fearing, E. L. Bartholomew, and W. F. Staunton. Also to Dr. Reber for permission to show his mapping of the surface geology.

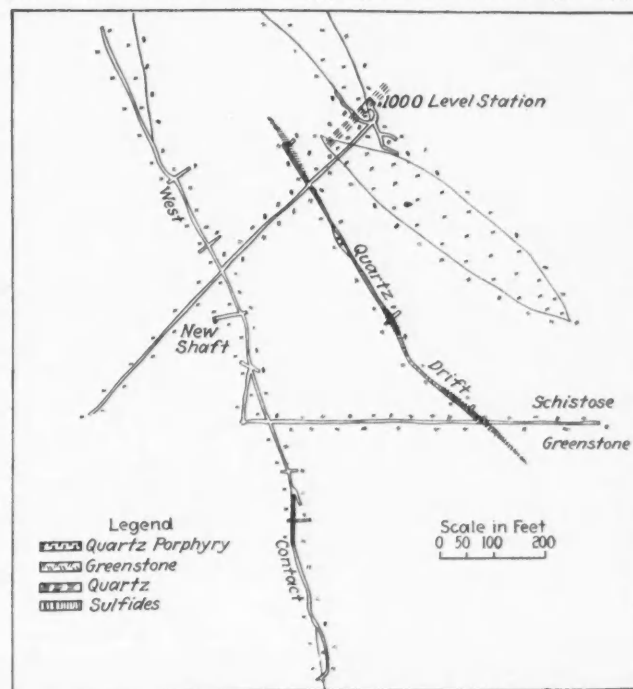


Fig. 4—Map of the 1,000 level, Verde Central mine

Discussion

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The Wastage of Petroleum

THE EDITOR:

Sir—The recently appointed U. S. Oil Conservation Committee, consisting of four Cabinet officers, resulted from the numerous addresses by H. L. Doherty, one of which was before the A.I.M.E. at the February meeting. Mr. Doherty severely criticizes the oil wastage in the present practice of developing gusher pools, and he suggests radical remedies that oil operators have not approved. By calling it oil wastage, he has attracted public attention, and so interested President Coolidge that the latter appointed the above-named investigating commission. Mr. Doherty's remarks are highly misleading as regards present practice wasting oil, as it is decidedly the reverse, for it recovers far more oil than under the remedy he suggests.

There is a gross wastage of money under the present extravagant methods of opening up gusher pools, but it is financial wastage, not oil wastage. It is severe on the pocket-books of the operators and usually more or less disastrous to most of the producers who flock to the discovery of gusher pools, but the public is benefited by a much larger recovery and often lower prices for oil—consequently cheaper gasoline—if it results in excessive overproduction.

When a gusher field is discovered, there is a rush of operators and speculators for leases that rapidly command an enormous bonus, or \$1,000 to \$10,000 per acre for the scrap of paper that permits excessive drilling, whereas before the well came in the same leases were selling for \$1 to \$50 an acre. Then follows an excited mob of contractors, drilling crews, pipe-line men, tank builders, and real-estate speculators, and boom conditions prevail. Shacks and houses are rapidly erected to take care of the increasing crowds, while supply companies build warehouses and switches to capture the booming market. Excessive prices prevail for labor and material, and temporarily there is great prosperity. A wild orgy of drilling takes place, as every operator rushes his wells to get the big flush production. Speculators will lease a farm at \$1,000 an acre and cut it up into one- to five-acre tracts that are subleased at \$3,000 to \$10,000 an acre. Pipe lines are extended to the pool and huge steel tanks are erected to take care of the rapidly growing production. Depending on the depth of the wells and the size of the pool, in six to twenty-four months the pool is defined, the gas pressure has been dissipated, the field is heavily overdrilled, and wells that came in at 1,000 to 10,000 bbl. are down to 10 to 100 bbl. per day. The boom collapses and an outbound trek begins that results in a shrinkage of 60 to 75 per cent of the population. The pipe lines have only 15 to 30 per cent as much oil to run as at the peak output, and after the storage tanks

are emptied they usually remain idle until another gusher pool is discovered.

There is a heavy financial loss in the excessive prices paid for leases, in too many pipe lines to take care of the moderate settled production, in the farms of empty tanks, and in deserted residences and warehouses. The too numerous wells have been needlessly costly from the rush speed at which they have been drilled, and many are on tracts of a quarter acre to two acres. But this heavy loss falls on the operators, pipe lines and boomers, not on the public. The nation is benefited by these feverish conditions, as probably twice as much oil is recovered from the pool as if it had been slowly developed with five to ten acres to the well, as proposed by Mr. Doherty, and if the output has been so large as to depress the crude market, the public usually gets cheaper gasoline.

There was a needless waste of oil in the earlier days that is now nearly eliminated. Formerly, when a gusher was discovered considerable oil went down the creeks from the overflow of the well while drilling, but by using oil savers this is now diverted to the tanks. There was waste as "B.S.," or an emulsion of oil and salt water from which the water will not separate by gravity, which resulted from the "cutting" action of the gas. Formerly this was burned in pits, to get rid of it, but now the oil is recovered by treatment with chemicals, centrifugal machines, and by other means. There is always a slight loss in high-grade oils on the lease from evaporation before the stock tanks are full enough to run into the pipe line, which may take one to ten days. By using vapor-tight roofs and good housing, this has been reduced to as low as 1 to 2 per cent for the average year's output (being greater in hot weather); as about 90 per cent of the output is run direct from the lease to refinery, the evaporation loss is now a small factor. Where oil is stored for long periods (half a year to three years) through overproduction, the evaporation loss is quite serious, especially during the first summer, but vapor-tight tanks, floating seals or scums, or painting the tanks white, has reduced this loss, which varies greatly, according to the gravity of the oil, being almost nil with heavy oils. Where formerly open earthen tankage (ponds) were freely used, underground tanks are now lined with cement and roofed, which greatly reduces evaporation losses and renders them safer from lightning. Where large quantities of light oil are to be stored for a long period, a temporary topping refinery is built to take off the light products, returning the heavy ends back to the tanks, which procedure greatly reduces the gasoline loss.

The industry frequently suffers from an exasperating and usually needless financial and mental wastage caused by the excessive number of Congressional investigating committees. In the last eight years, twelve investigations have been ordered by the La Follette type of demagogues, who are thereby enabled to get on the front page of the daily press and curry favor

with the masses. The latter do not realize that out of the 15,000 oil operators, the Standard companies only number about fifty, so that baiting the oil industry is assumed to mean only the Standard, which is always popular with the radical vote getters.

A very important matter that this commission should consider is the oil that remains in the sand after the yield of the wells is so small that it no longer pays to pump them. This residual oil is estimated at 70 to 80 per cent of the original sand contents, as the natural gas pressure that drives the oil out of the sand to the wells is supposed to recover not more than 20 to 30 per cent. Efforts have been made to increase the recovery by means of a vacuum, by compressed air, and by flooding, with variable success. Recently, mining has been considered, which would insure a maximum recovery, but, like shale oil, it will probably require higher prices than now prevail to be profitable.

St. Louis, Mo.

H. A. WHEELER.

New Mines

THE EDITOR:

Sir—Recent published expressions of opinion from more or less authoritative sources would indicate varying degrees of apprehension concerning possible and early exhaustion of present national mineral resources; and these writers also venture rather pessimistic forecasts on the dwindling areas of possible new mineral territory in North America.

Tracing some of this gloom to its various fountain heads, it will be found that the bulk of it is disseminated either by the younger generation of examining engineers, worn out by fruitless search for bargains in developed or partly developed orebodies; or by older mining engineers who have handled more "slide rules" than they have "picks and shovels."

There are a lot of older engineers like myself, bow-legged from much mule-back, with a background of blended memories of hard, steep trails, swinging ore buckets, swinging lunch buckets, coupled with a thousand and one distinct mental impressions of different kinds of vein outcrops, underground "faces" of ore and rocks, fissures, slips, and faults, all constituting an equipment denied to younger engineers in the examination of new ore-finding propositions.

In attempting an analysis of the present outlook for the discovery of new mines, if one is rigidly accurate, one must start with the confession that "engineering" (as the term is generally understood) plays small part in the operation of metal mines and less in the discovery of them. After thirty-four active years as mining engineer, the only "engineering work" I was ever called on to do was to swing a transit and design a headframe. But this thirty-four years of North American mining experience has implanted in the back of my head certain convictions impossible of dislodgment by any purely technical forecasting of early exhaustion of old and possibly new and prolific prospecting areas.

Why so "bull-headed"? Well, to start with—because I have found underground too many unexpected orebodies that had given no indication at the surface of their existence below. Again—at every mining camp where I lived, I have found adjacent to productive or former productive mines, the unprospected outcrops of extensions of the same or similar veins, the only thing

missing from them being a commercial oreshoot at the surface.

I do not believe there exists in the West an abandoned, but formerly productive, mining camp that does not contain, lying below the surface, dormant (because of lack of technically attractive outcrop) one or more commercial orebodies as yet unworked or even developed, or even suspected. There is not a mining camp in the West into which I cannot venture and locate, or lease, or buy undeveloped ground from which I can get at the surface assays of at least \$2 per ton in gold or silver, or at least find traces of copper and lead in the leached, untouched outcrops. "But such stuff is not commercial!" Assuredly not; but neither are the thousands of feet of similar stuff between oreshoots along the veins in adjacent productive, or formerly productive, mines at depth.

How many of us have ever stopped to consider the effect on the metal markets of the world if every vein or deposit had exhibited primarily at the surface the tips of all its various possible and probable oreshoots? Is it not true that with such a profuse exhibition of wealth exposed all at once this would have resulted in a plethora of metal that would have profoundly influenced earlier civilization and left us bankrupt for metal in the present and future civilization?

Our experience in developing productive mines should tell us that (other conditions remaining similar) a \$2 assay following an hundred feet of \$50 assays in drifting on the 500 level on the same vein does not mean "Stop!" Neither should a \$2 assay at the surface (other conditions being favorable) deter an exploration company in search of new mines from doing some digging on that apparently friendly outcrop. Because of past experience and technical training no one can accuse me of prejudice when I say that, while mining geologists are of utmost aid in our search for ore veins and deposits, obscure, faulted, or otherwise, such professionals are entirely unnecessary in the business of locating hidden oreshoots in such veins as are already found. There is only one potent agency in the finding of oreshoots that happen not to outcrop at the surface of definitely located veins, and that agency is dynamite.

The great exploration companies are tangled in a maze of technical procedure which "gets them nowhere" in their search for new mines. They will not bother with \$2 outcrops, but continue year after year to hunt for an ensemble of favorable conditions that Mother Nature does not permit to exist. They have proven this by their own files stuffed with 4,000 or more eliminated propositions.

If such companies will devote half their former examination expense to wildcatting, under experienced direction, on certain selected "\$2 outcrops" they will soon open a new reservoir from whence will come much of our future metal supplies. I hear some such exploration companies say: "We have tried that kind of gambling, and there is nothing in it." To such I would say:

Who did the work?

How old was he?

What experience did he have?

What salary did he receive?

What interest did he have in possible discoveries?

What latitude in research did he have?

What was his personal reputation for integrity and enterprise?

How much authority did he have?

How much working capital was he allowed?

Answer these questions and any old-timer can tell any one interested why most exploration companies fail.

Speaking of old-timers, it is interesting to note that the great producing mines of the last 100 years in North America were discovered by non-technical old-timers, so called. The great mines of the next 100 years, on this hemisphere, will be discovered by middle-aged, experienced geologists unafraid of dynamite and working for reasonably large salaries and holding at least 15 per cent interest in all of the discoveries that they may make.

The young professional engineer on straight salary is not going to find a damn thing except experience.

This is what I understand by the expression, "Evolution of Mining."

PERCY WILLIAMS.

Silverbell, Ariz.

Mining Finance

THE EDITOR:

Sir—Referring to your editorial "Mine Financing," in the *Mining Journal-Press* of March 14, 1925, we agree with you that any prospect or mine can be promoted honorably, but the question arises, "why not successfully?" For it is a fact that a mine can be promoted honorably until the mining-operator promoter gets grey-headed or bald without producing the necessary and adequate funds to develop such mine. And why? Because the great American public is not interested in plain honesty and cold truth, even if engineer's and geologist's reports are included.

The big investor and capitalist is not interested in the struggles of a new and comparatively small enterprise in its beginning; therefore, the average mining promoter must address the small investor. Such efforts, though, as a rule, if made honorably, do not furnish the expected results, because the great American public is still falling for the literature used by such promotions which you class as not honest.

To attain results, what would you suggest to the honest promoter? We mean the man or organization who has no financial connections, but who has a property worthy of being developed. If you can solve this problem you will be a genuine benefactor toward future mine developments. You may perhaps easily devise a theory of some kind in your office at New York, but did you ever try to promote a mine honorably, by putting yourself on a level and in exactly the same position with the average mining promoter, by not using your well-known name and its influence? Just try it once, and you will learn a lot. Why! even Douglas and Tener could not have promoted honorably and thereby financed the U.V.X., if they had not been nationally known and could not have used the influence of their names and business connections. And you know it!

We are talking from experience, and we are still experimenting and trying to induce the American people to speculate "for once" in truth and honesty. To go into all details of the handicaps an honorable promotion has to face and to overcome would fill this issue of the *Mining Journal-Press*.

Hachita, N. M. LITTLE HATCHET MINING Co., INC.

Exploration Campaigns

THE EDITOR:

Sir—I am impelled to criticise your editorial in the issue of March 7, under the title of "Exploration Campaigns." I do this only because the quoted reports of the mining companies as used by you, and your comments thereon, seem to me to be decidedly unfair to the mining industry, a conclusion probably not intended by the mining companies and surely not so intended by the *Mining Journal-Press*.

To the average reader the report of the unnamed mining company reads and sounds as if it found only four mines out of 4,000 properties submitted for consideration, while as a fact this is far from the truth. On reading the company's report, as quoted by you, we find that 90 per cent, or 3,600 of the 4,000 entries, never even got a chance to start, being turned down on the reports submitted; of the remaining 400, we are told that in no case did the reports submitted agree with the findings of the company engineers. What a slam at the engineers of the country; and yet you say that, among others, the mining engineer is the man that capital awaits to show the way. Which engineer?

The obvious conclusion as to this report is that the office engineer of this company turned down 3,600 reports of engineers in the field, without an effort to check up on them, and after checking up on the remaining 400, there was not even one case where they agreed.

But they say that work was done on "about twenty-five," and out of this number they secured what we presume was four good ones. So, instead of only four out of 4,000, it was really four out of twenty-five, for almost anyone will agree that the only real determination of a mining property is had by actual mine development work.

Then your article quotes the report of the efforts of the Barnes-King company in Montana to find a real mine. Like the unnamed mining company, the Barnes-King, too, starts off with the big figures first. It says that 1,029 mining properties were "considered"—whatever that means—but only 473 were examined by engineers, and why they do not start with this number instead of the greater one seems strange. However, it appears that during the last year 249 out of the 473 were again "considered" and 64 were "physically examined," and, finally, eleven were taken under option and "some work done on them," with no results. Again applying the test of real and actual work done, we find that instead of 1,029 failures, as the report implies, there were really only eleven.

If the publication of reports such as these is not discouraging to capital and to mining, then I cannot imagine what would be, and, wouldn't you say, discouraging to mining engineers also. The truth does not hurt any mine or mining district, and is welcomed by any fair-minded man, but the truth in a mining matter should be based at least on a careful personal examination by a qualified engineer, and better still by more than one, as the mining regions have good reason to ask.

I must still insist that the real truth about a mining property is developed only by actual mining work, by mixing in a few hundred dollars worth of practical digging with the technical and professional opinion, and when this is more generally done, we can expect something of our old-time mining activities back again.

Helena, Mont.

F. H. DONALDSON.

News of the Week

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

Summary

THE Quebec Government has opposed the construction of the branch railroad into the Rouyn district by refusing to give a right-of-way.

High-grade battery manganese is being searched for by the U. S. Department of Commerce.

The Grasselli Chemical Co. has bought one of the Barnsdall Zinc Corporation's properties in the Joplin-Miami district.

The Wolverine Mining Co. has suspended operations in the northern Michigan copper belt.

The longest raise ever to be driven in the Coeur d'Alene district will soon be built to reach the Star

workings from the Star crosscut of the Hecla Mining Co.

Portland Canal district, in British Columbia, is planning an extensive program of development.

The Humboldt smelter, in Arizona, will remain closed temporarily on account of poor metal prices.

The U. S. Tariff Commission is investigating the magnesite situation.

Inland Steel has bought a half interest in the Wakefield iron mine.

Increasing use of electrical equipment is noted in many of the Transvaal gold mines.

Mesabi Range Preparing for a Big Season

Preparations are going ahead all along the Mesabi range to have equipment in first-class condition to open the 1925 ore shipping season. The Great Northern R.R. has started laying double track between Hibbing and Kelly Lake on roadbed prepared last fall. This will make possible a great increase in ore shipments from Hibbing and Chisholm to Kelly Lake, from which point ore is sent to Duluth and Superior dock. With favorable weather this work should be completed in sixty days.

The Minnesota Power & Light Co. recently completed the last link in a great network of power stations and transmission lines which has joined the principal water-power resources of north-eastern Minnesota and covered the Mesabi range with enough electric power to change all the mines from steam to electric drive. Three complete transmission lines now parallel the length of the range and are so equipped with cross switching that a breakdown in any section can be cut out and power supplied from some other line with practically no delay. The hydro-electric generating plant at Blanchard Rapids, on the Mississippi River, with an initial capacity of 18,000 hp., began operation in March and carries its current 137 miles to the Cuyuna and Mesabi ranges at 110,000 volts. The dam at this plant was started over a year ago and cost \$3,000,000. This dam is the first of four to be installed later on the Mississippi River, the others to be at Rice, 8 miles below Blanchard Rapids; at Clearwater, 14 miles south of St. Cloud,

Record Raise To Be Driven to Reach Star Workings

THE longest or "tallest" upraise ever made in the Coeur d'Alenes will be driven from the famous Star crosscut to the old upper workings in Star property—2,800 ft. In preparation for this, the Hecla management, which is doing the Star work for the Hecla and Bunker Hill owners, has begun to crosscut into solid ground, where a station will be made from which the upraise will be started. This work will be back some distance from where the Star work is now in progress.

and a fourth at an undetermined site between Clearwater and Elk River.

From present business conditions the mine operators now feel that approximately 10,000,000 more tons of ore will be shipped down the Lakes than were shipped last year.

C. & H. Resumes Railroad Construction

Construction work has been resumed on Calumet & Hecla Consolidated's Ahmeek railroad between the Ahmeek mine and stamp mill, in the Michigan copper district. A large steel span near the Torch Lake terminal is being erected. Only a few large fills remain, and this work will be started soon. Concrete construction and most of the grading have been completed. Laying of steel will be under way early in the summer, and completion of the project is scheduled for July 15.

Michigan Copper Production Being Maintained

Estimated refined copper production in the Michigan district in March was 11,650,000 lb. Calumet & Hecla Consolidated produced 6,400,000 lb., made up of 2,900,000 from Ahmeek, 1,500,000 from the reclamation plant, and 2,000,000 from the conglomerate department. Mohawk produced 1,600,000 lb.; Quincy, 1,000,000; Isle Royale, 750,000; and Copper Range, 1,900,000.

March deliveries from the smelters in the Michigan copper district were on a par with those of February, and more than 10,000,000 lb. was shipped. Only rush orders are being filled with rail shipments. The opening of the Lake navigation season, when railroad freight rates will be reduced 6c. per 100 lb., or \$48 per car, is expected to hasten the return of normally large spring deliveries. Detroit and Chicago are absorbing most of the metal being forwarded now, only negligible quantities going eastward and practically none being shipped to Europe. Wire shipments from the Dollar Bay plant of the Roebing company are seasonably brisk. Approximately 1,000,000 lb. of Calumet & Hecla metal was received at this mill in March.

New Pumps for 85 Mine

Sinking of the main shaft from the 1,350 ft. level to the 1,650 ft. level has recently been completed at the 85 Mine, at Lordsburg, N. M. A new water column and two new 200-gal. pumps are being installed. With this equipment it will be possible to pump the mine water from the 1,650 level to surface in one lift.

Extensive Exploration Is Spring Program in Portland Canal

Look for Another Premier—Ore Reported in Indian—
Good Orebody in B. C. Silver

EVERYTHING points to 1925 as a noteworthy year in development of mining properties in the Portland Canal district of British Columbia. Large quantities of machinery have been contracted for by various companies and are being rushed into the district to be hauled to the mines before the snow disappears.

Diamond drilling which has been in progress at the Indian mine for some time has been discontinued and reports indicate that some rich ore has been located. The diamond drills were used in No. 3 tunnel crosscutting both ways at intervals throughout its length of 1,285 ft. Exceptionally rapid work was done, 2,200 ft. of holes being bored in thirty days.

The latest reports from the Victoria Mines property have also been encouraging. The tunneling is being done by contract, and the average of 85 ft. a month is considered an excellent record for the number of men employed. To date 250 ft. of tunneling has been completed, and there is 250 ft. more to go. A break has been made into the ore zone, showing 12 ft. of low-grade ore.

Immediate development work will start on the well-known Bush property, owned by O. B. Bush and associates, of Vancouver. The Bush group, with which is consolidated the National group, consists of twenty-four claims and adjoins the B. C. Silver and Premier groups on the north. It is proposed to do extensive diamond drilling preparatory to mapping out a development program. The consolidated property is owned by the National Silver Mines, Ltd.

In the B. C. Silver Mines, adjoining the Premier and lying in the same mineralized zone, exploration work has been diligently carried on by diamond drilling. The American Smelting & Refining Co., controlling the Premier

Gold Mining Co., has a minority interest in the B. C. Silver, the control of which rests with the Selukwe Mining Corporation of London. In a recent letter sent out by C. A. Banks, mining engineer and managing director of the B. C. Silver, to shareholders in this company, he says:

"I have to inform you that diamond drilling from our No. 3 level has just intersected a very important orebody. The drill passed through 58 ft. of ore, which, allowing for the dip of the vein, indicates an orebody of 45 ft. in width. Ten feet of the drill core averaged \$22.80 per ton; twelve feet \$30 per ton, and nine feet \$40 per ton, the whole orebody being of commercial grade. Further drilling is being pushed ahead to determine the extent of this orebody."

On the Silverado, the Terminus, the Independence, and other promising properties in the Portland Canal region recent development work is being pushed. The Silverado drove through No. 1 vein at 640 ft. from the portal and found it barren, but a drift northerly broke into high-grade silver ore, which is reported to have yielded assays of \$2,000 to the ton. Assays which the owners refuse to divulge, claiming that they were too high to print, have been made of recent ore finds in the Terminus.

On the Independence, it is reported, the vein was crosscut in the tunnel 400 ft. from the portal and proved to be 38 ft. wide at most satisfactory values. At the Riverside property, 7 miles up the Salmon River from Hyder, a concentrating plant is working to capacity handling sixty tons of ore a day and turning out fifteen tons of concentrates. There is on this property, which is owned by Messrs. Strong and Barber, of Ketchikan, and Black, of Seattle, a mile of underground workings and some blocked-out ore.

Wolverine Suspends Operations

Branch of Mohawk Mining Co. Had
a Long Life

The Wolverine branch of the Mohawk Mining Co., in the Michigan copper district, suspended operations April 1, having reached the end of its career. Wolverine produced approximately 185,000,000 lb. of copper, and paid \$10,350,000 in dividends between 1898 and 1920. For many years it was the richest amygdaloid mine in Michigan district.

Wolverine's career was terminated only by boundary lines. In late years it has been in practical liquidation, working from the bottom upward and taking out rock from pillars and footwall of old stopes. The footwall rock was of lower grade than that previously mined and returned an average of only 16 to 17 lb. of copper per ton. When Wolverine was merged with Mohawk it turned over options on 320 acres of land, to the west of the Wolverine property, carrying the Kearsarge lode at depth and other veins, including the Pewabic, nearer surface. Mohawk already has done some trenching work in this tract and it is understood the showing, particularly in the Pewabic formation, is encouraging. Further attention will be given this bed, probably this year. Wolverine has valuable equipment and a two-head mill.

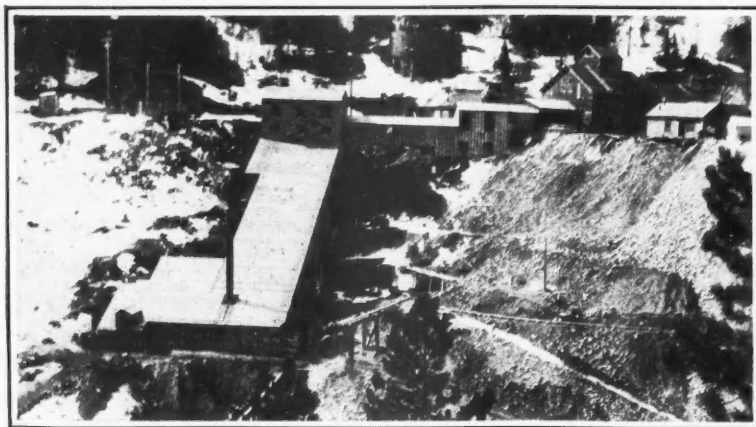
Suspension of operations at the Wolverine branch will enable the Mohawk Mining Co. to bring production from the Mohawk shafts up to capacity of its mill. The Wolverine underground force will be given places in the Mohawk shafts, and this increase in manpower will be reflected in a larger daily tonnage and a more extensive program of opening work in the three working units. Mohawk is averaging about 2,300 tons of rock daily; the capacity of the mill is 2,600. For some time Wolverine rock has been stamped in the Mohawk mill, which has been operated continuously. Additional tonnage from the Mohawk shafts will replace Wolverine rock. The net result should be a somewhat larger copper output.

Cutting Mining Co. Ships Flotation Concentrate

A fifth car of concentrates is being loaded by the Cutting Mining Co., operating near Central City in the Black Hills region in South Dakota. Four cars have been shipped since the new flotation plant was placed in operation in January and an average of forty tons of ore is handled daily.

The Cutting company is the first to employ oil flotation in South Dakota, and the results are said to be very satisfactory. The flow sheet of the mill is as follows: Ore from mine to crusher, to conveyor belt, to storage bin, to feeder, to rod mill, to classifier; coarse back to rod mill; fines to two Brown oil-flotation machines; concentrate to storage; tailings to Deister table; concentrate to storage; tailings to waste.

The plant, though of a maximum capacity of 50 tons, is so arranged that new units can be added to increase the output. The surface equipment and flotation plant are shown in the halftone.



Fifty-ton flotation plant of the Cutting Mining Co., in the Black Hills
of South Dakota

**Grasselli Chemical Buys a
Barnsdall Zinc Mine**

The Grasselli Chemical Co. has entered the Joplin-Miami district for active ore production. Announcement has just been made of its purchase of the No. 1 mine of the Barnsdall Zinc Co., at Waco, Mo. The purchase was made after careful investigation by the Grasselli company, much drilling having been done. It previously held an option on the Easy Money mine, south of Hockerville, but could not come to terms with the owners.

Almost simultaneously with the above-noted announcement came another to the effect that the Barnsdall Zinc Co. has purchased the Chanute Spelter Co.'s Brewster mine, at Baxter Springs, Kan. This was the last of the Chanute properties in this section to be sold, its leases on the Hartley and Ebenstein tracts having been sold some months ago.

The Barnsdall Co. recently opened a property on the Hartley land, west of Baxter, and is also operating the Good-eagle mine, in the Oklahoma field.

**Ship Mica and Feldspar from
South Dakota Mines**

The Dakota Mica Co. has purchased property east from Pringle, S. D., has installed a compressor and machine drills and is now marketing both plate and scrap mica.

The Keystone Feldspar & Chemical Co., of Keystone, S. D., is making regular shipments of feldspar to Chicago. The company has also taken over the Peerless property and has made several carload shipments of mica from it.

The Old Mike mica mine, at Custer, has been placed in condition for regular shipments of mica.

**Expedition to Leave for
Mackenzie River Oil Field—**

**Extensive Drilling Campaign Planned
by Angus Sutherland and Party**

The Imperial Oil Co., of Toronto, hopes that the operations arranged for this season in the Mackenzie River district will enable the company to reach a definite decision as to the value of that field. A party under Angus Sutherland, who superintended work last summer, will leave Calgary for Fort Norman as soon as it is possible to travel, reaching its destination probably by July 1, when drilling will be continued at No. 2 well, which is now down 800 ft. and will be sunk 500 ft. further, to the same depth at which oil was struck in No. 1 well. The company's plans for the future will depend largely on the result of this season's drilling.

Plans have been made to start drilling on the two new wells near the No. 4 Royalite, in the Turner Valley field, within thirty days. The new rotary outfits to be used have been hauled to the location. Preparations are being made to continue drilling in the Pine Creek well, west of Nanton, Alta., which is now down 1,100 ft. The season's program also includes further

drilling at the Dead Horse Coules well, east of Coutts, Alta., and near the international boundary, now down about 1,000 ft., and the sinking of the well at Coal Spur, west of Edmonton, from its present depth of 3,100 ft. to 5,000 ft. if necessary.

**Northern Ontario Making
Record Silver Output**

Figures compiled by the *Northern Miner* for the gold and silver production of northern Ontario for the first quarter of the present year show substantial increases. Production of the gold mines for the period is indicated at \$7,350,000, or at the rate of \$29,400,000 a year. This production, which constitutes a new high record in the history of the province, should be exceeded during the present quarter, the chief increases being expected from the Hollinger and the McIntyre. There should also be an increased output from the Argonaut and Tough-Oakes properties, in the Kirkland district.

Production from the silver mines is estimated at 3,100,000 oz., which is the highest since 1918. There has been increased production from Cobalt, and particularly from South Lorrain, where splendid results are being encountered on the property of the Mining Corporation.

**Missouri Zinc Output Expected
to Increase**

It seems likely that the output in the Missouri portion of the Joplin-Miami district will be increased materially in the months to come. Several new mines are just being opened and much prospect drilling is under way.

The Kansas Explorations Co. seems to have a good property in its Isherwood mine, near Smithfield, initial production being very satisfactory. Butler Bros., of Joplin, announce their intention of erecting a mill on the McBee land, in the same territory.

Frank Childress, of Joplin, and associates, are drilling out a considerable acreage on the Missouri side in the Waco camp, with indications that at least one mill and possibly two will be placed in operation there soon; and the H. and C. C. Mining Co. has an exceptionally promising property in the old Imperial mine, which is close to the state line, but in Missouri, west of Joplin.

**New Mill at Bonanza, Near
Deer Lodge, Mont.**

It is reported that the owners of the Bonanza mine, formerly called the Emery, will build a \$70,000 mill. The Bonanza is about 12 miles from Deer Lodge, Mont., and is one of the oldest silver-lead mines in the district.

Considerable development work has been done in the last year, and the results thereof are said to justify the building of the mill. An electric power line has been installed.

Mystery in Manhattan Strike

Southern Nevada is well stirred up over a reported rich strike of gold near Manhattan. An element of mystery is connected with the discovery, in that none but a selected few have been admitted to the workings. One sample exhibited was a blue shale gouge, and when panned delivered up a surprising string of fine gold.

No well-informed engineer has yet made an examination of the shaft, which is down about 100 ft., and doubts are freely expressed as to the authenticity of the strike. However, one man who was admitted to the workings took samples which assayed from \$150 to \$4,000 per ton. Claims have been located for miles around. Old-timers predict that Manhattan is to be the scene of another boom.

**Idaho-Montana Asbestos Co.
Plans to Build Mill**

The Idaho-Montana Asbestos Co., the property of which is situated 30 miles from West Yellowstone near the Montana-Idaho border, is planning to erect a mill for crushing and separating fibre from its ore. A hydro-electric plant is being built on the Madison River, from which power is to be obtained.

The fibre is a chrysotile of spinning quality, similar in many respects to that occurring in Arizona. The Arizona asbestos is associated with a magnesian limestone or dolomite, whereas the Canadian fibre occurs in irregular veins in massive serpentine. Unlike the greenish-white crude fibre from the Quebec region, the veins are a deep golden yellow. J. E. Kennedy, of the Kennedy Van Saun Manufacturing & Engineering Corporation, is associated with the new company.

**Exploration Important Part of
Michigan Copper Activity**

**Franklin, Mayflower-Old Colony, and
Calumet & Hecla Search for
New Orebodies**

Several important exploratory projects are under way in the Michigan copper district. At Franklin's Kearsarge lode exploration, the shaft is down in the vein 180 ft. Sinking is progressing at the rate of about 13 ft. a week. The shaft probably will be sunk at least 500 ft. before drifting is started. This program, however, will be changed if conditions appear to warrant lateral openings before that depth. The vein has been carrying a little copper right along, and the prospects are regarded as encouraging. The lode is strong and of average width, and has the Kearsarge characteristics. Commercial copper content is not expected until greater depth is reached. The shaft being sunk is large enough to be converted into a good working shaft.

Mayflower-Old Colony will continue during the greater part of the year to push its crosscut west from the 1,700 level toward the St. Louis amygdaloid. The opening is being driven at the rate of about 100 ft. per month, and it is estimated it has 600 to 800 ft. more

to go before the objective is reached. The crosscut is being pushed through a barren trap formation. The St. Louis amygdaloid appears to be well mineralized, judging from diamond-drill cores obtained from this vein. Furthermore, it lies out of the broken, faulted area in which the Mayflower-Old Colony has been working.

Calumet & Hecla Consolidated, which has started exploratory work in its Cliff and La Salle lands, has no other exploratory project in immediate prospect. Additional recommendations covering developments in the lands of the company have been made by geologists, and it is stated this work will be prosecuted as favorable opportunity presents itself.

Crosscutting now is under way in the La Salle lands. This exploration is one of the most important on the Calumet & Hecla program, inasmuch as it will traverse 2,500 ft. of practically unexplored territory and cut several lodes, among which are the Osceola amygdaloid, Calumet conglomerate, Allouez conglomerate, and two or three unnamed amygdaloid veins.

Mason Valley Getting Ready to Produce

It is expected that by the middle of next summer, the Mason Valley Mines Co., operating in the Youngstown district, in Nevada, will again be producing copper. Considerable alteration work is being done at the smelter. The capacity of the flotation mill is being increased to 1,000 tons per day. This will require considerable construction work and additional machinery.

At the mine, much development work is being done, and preparations are being made for efficient handling of material. The mines are located at Ludwig, Nev., and the smelter is at Thompson, Nev. They are served by the Copper Belt R.R. which connects with the Southern Pacific at Wabuska.

Goldfield Consolidated Cyanide Plant Junked

The 1,200-ton cyanide plant of the Goldfield Consolidated Mining Co. at Goldfield, Nev., has been sold as junk, and will be scrapped. The mill was erected in 1909 at a cost of about \$1,000,000 and was operated for nine years, turning out almost \$80,000,000 in gold. When new it was considered the most efficient type of cyanide plant. Concentrates were treated in a special treatment plant which included roasting. Now there is no treatment plant in Goldfield, and ore is shipped by railroad to the Tonopah mills.

Work on Plan to Continue Gold-Silver Cost Investigation

No formal announcement in connection with the continuation of the mining-cost investigation which was two-thirds completed by the Senate Commission of Gold and Silver Inquiry is likely to be forthcoming before the middle of April. Time is required to work out the details of such a matter, and in this instance considerable correspondence has been found necessary.

Toronto Letter

By Our Special Correspondent for
Northern Ontario

Rouyn Branch Railroad Opposed by Government

Quebec Officials Refuse to Give Necessary Right-of-Way—Silver Production Increases

Toronto, April 4—Consternation has been caused in Ontario Government circles by the action of the Quebec Government in opposing the entry of a Nipissing Central branch of the T. & N. O. Ry., into the Rouyn district, and the refusal to grant a right-of-way. The right-of-way lies through the Riordan pulp limits, and there was no difficulty with the company, but the surface belongs to the Quebec Government, from which permission must be obtained. The Nipissing Central has a dominion charter, and though the right-of-way can be denounced, the present situation has resulted in an unfortunate impasse. The Ontario Government, on account of the lateness of the season, rushed the work and put hundreds of teams to haul in supplies before the roads broke up. This was done even before the contract was let, so as to facilitate construction. The Quebec Government seems determined to retain the business arising out of the Rouyn mining field for itself and is backing a new proposed line, called the Abitibi Southern. Even if the Ontario road is put through, Quebec has the whip hand over the mining companies by virtue of its control over taxation and the government treatment to be accorded to mining companies, which is an important consideration.

Tough-Oakes Ore Improved at Depth

At the Tough-Oakes mine, in the Kirkland district, better ore is being found at depth. Recent developments on the 900 and 1,025 levels are showing better results than in the upper part of the mine. The oreshoots are not only longer, but the grade of the ore is better and the values are more consistent. As a result, it is expected that in April the company should be able to show a profit, and if development progresses as indications promise, the company should be out of the "red ink" side of the ledger from that time on. Workings are to be continued to a depth of 1,275 ft., with new levels opened up at that depth and also at 1,150 ft.

On the Gold Hill property, near the Kirkland district, a contract has been let to sink the 100-ft. shaft to a depth of 300 ft. and to do several hundred feet of drifting. Down to the 100-ft. level the vein carried substantial values over a width of six to seven inches. The shaft is now down 175 ft., and the vein has widened to a width of two to three ft. The property is being financed by a Toronto syndicate, and sufficient money has been raised to carry out the program outlined.

The American Smelting & Refining Co. is to examine the Hattie property, with a view to taking it over under bond and lease if the examination warrants the expenditure.

The new developments at the La Rose mine, of Cobalt, continue to be favorable, and in the station being cut at the 880 level high-grade ore has been found. This ore is of better grade than was indicated on the 830 level, and indications are that the company will have a substantial production.

The financial position of the Nipissing mine, as of March 31, shows liquid assets of \$4,428,527.

Australian Letter

By Our Special Correspondent
for Queensland

Many Old Queensland Properties Being Reopened

Improved Price of Lead and Zinc Revives the Industry—New Diamond Field Reported

Brisbane, March 5—An interesting Queensland mine is the Silver Spur, in the Stanthorpe district, managed and partly owned by Edgar Hall. After encountering, and where possible overcoming, many difficulties that have for a time caused temporary suspension of work, Mr. Hall has at last apparently found "a way out" that promises success. The mine, opened many years ago, was primarily a silver property, other metals obtained from its ores including copper, gold, and lead. There were also great quantities of zinc ore, but in past years this was considered worthless. Now it has become of great value, and mining has for some time been confined entirely to the stoping of this class of ore. A lack of adequate transport facilities has been a serious problem. For many years those interested have been led to expect the building of a branch railroad to Inglewood on a main line 50 miles distant, but their hopes have not been realized. Now Mr. Hall is carting the zinc ore to the railhead by steam motor lorry, and this method of transport is proving successful. On reaching Inglewood it is railed to Brisbane, 230 miles, and thence despatched to Germany, where he is disposing of it at a profit. The route traversed by the steam tractor is through bush country, and the advantage of steam over petrol to generate power is that wood fuel is picked up along the road.

Tin Properties Being Reopened

There are several mining "camps" in Queensland besides Silver Spur that have been handicapped by their remoteness from other centers or from a port. One of these is the Stanhills tin field, near Croydon, in the Cape York Peninsula. It was worked nearly twenty years ago, but was abandoned and lay idle a long time. Now another effort, which promises success, is being made to exploit its undoubted mineral wealth, and an official report says that there is every possibility of its becoming one of the important tin producers of the state. There are numerous lodes on the field, and many are stanniferous, and where being prospected are improving both in size and value with depth. The greatest depth reached as yet is only 100 ft., but in each of three

new shafts already sunk there is payable ore in the bottom.

A discovery of diamonds has been made in the Stanthorpe district, near the southern border of the state. Six gems in all were found in the "wash" by alluvial, or placer, tin miners. The rarest was a flawless green diamond, weighing about one carat. In the past, diamonds from time to time have been found in this district, but not in sufficient number or large enough to engage the serious attention of miners, but the finding of this green specimen, one of the rarest gemstones in the world, is likely to lead to a systematic search.

According to the last periodical re-

For some time trouble has been threatening at Broken Hill, New South Wales, over demands of the miners for better wages and easier working conditions, but when the last mail left it seemed that this would be averted. Mine managers, on behalf of the companies, have agreed to allow some additional concession in respect to an automatic increase in the wage bonus suggested whenever lead reaches certain prices. The proposal, which is likely to be accepted, is that instead of starting the bonus when lead is at £33 a ton, as heretofore, it is to begin with 2d. a shift when lead reaches £30 a ton, to be 3d. a shift when the price is £33 a ton, and 4d. a shift when the metal is

Utah Apex Mine in Good Financial Position

The Utah Apex mine, at Bingham, Utah, is in a prosperous condition, having the largest working capital in its history, with its only debts, fixed or liquid, consisting of current operating bills.

It is estimated that the March earnings of the company will be about \$175,000, which will bring the total for the first three months of the year up to \$515,212. As there are 528,200 shares outstanding, this would make the annual rate about \$4 a share.

Cash balances of the company, consisting of cash and United States



Wico mine of the Wakefield Iron Co. on the Gogebic range near Ironwood, Mich.

port of E. Bails, superintendent of the Mount Isa Co., satisfactory results continue to follow development work on all the mines being operated by that company. The management intends, in the coming few months, to concentrate such work on some of the company's more important leases. In most of the mines the proportion of lead values compared with silver is becoming greater with depth, but with the present high price of the first named metal this is not considered to be a detriment. The Rio Grande mine, now down to 155 ft., continues in ore averaging as much as 38 per cent of lead and 30 oz. of silver per ton over the 4 ft. of the shaft's width, and in two other shafts in the same mine the grades are 24 per cent of lead with 22 oz. of silver and 18 per cent of lead and 5 oz. of silver, respectively.

In the Proprietary Company's Ibus mine, on the Mount Isa field, the average assay values in a western crosscut at a depth of 175 ft. have been a little over 9 per cent of lead and 6 oz. of silver, with 10 per cent of zinc, but in the face at present ore is being got assaying nearly 39 per cent of lead and 26½ oz. of silver, with 11 per cent of zinc. A diamond drill for prospecting has been installed on this lease. Regular shipments of ore, won in prospecting and development work, are being shipped from this mine to smelters abroad. So far, the present company has not dispatched ore from any of its mines, although the government geologist says it could do so profitably.

£41 a ton or more. When the proposal was made the price of lead was about £37 a ton, at which price the bonus would amount to 10s. 6d. a week. The present basic wage is 15s. a shift.

Inland Steel Buys Half Interest in Wakefield Iron

The M. A. Hanna Co. has sold a half interest in the Wakefield Iron Co. to the Inland Steel Co. The principle property of the Wakefield company is the Wico open-pit mine, situated at Wakefield, Mich. This mine is shown in the accompanying illustration. It was originally worked as an underground mine, as most of the iron formation in this district dips steeply. Underground development, however, indicated several unconformities, and exploration finally showed that through faulting a large section of the iron formation had been thrown into a horizontal position, and near enough the surface so that it could be worked by open-pit methods.

C. & H. Copper Inventoried \$5,866,908 at 14.65c. on Jan. 1

Calumet & Hecla Consolidated, operating in the Michigan copper district, had copper on hand at the end of the year to the value of \$5,866,908.75. This is equivalent to 40,047,200 lb., based on the price of the metal, f.o.b., refinery, Dec. 31, which was 14.65c. per lb. The company's copper sales in 1924 brought \$9,229,251.41.

Treasury certificates, amount to \$1,140,000.

About 700 men are now employed, compared with 300 six months ago. Work is being pushed on the 2,400 level in a heavy mineralized limestone. About half of the ore mined is a direct-smelting product.

Commonwealth Mine Has a Cave-in

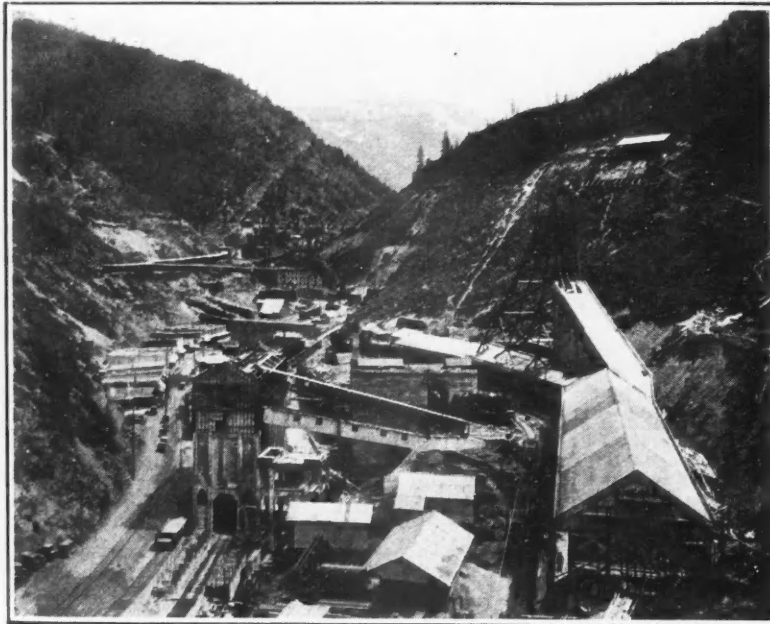
About \$7,000 worth of equipment was lost when the southwest drift of the Commonwealth Mining Co.'s No. 2 mine, two miles south of Baxter Springs, Kan., caved in on March 29. The mine's blacksmith shop and tools, a 100-hp. boiler, two motors, and a number of ore cans and steel were among the material buried. No one was injured.

The mill shaft was damaged and the derrick and hopper put out of operating condition, though the mine will be able to run with "dirt" taken from the east shaft, which has been the principal source of supply in recent weeks.

The mine is owned by E. R. McClelland and J. W. Perry, of Kansas City.

Chloride Queen to Install Milling Machinery

The installation of machinery in a mill building of the Chloride Queen Mining Co., 13 miles northeast of Colville, Wash., has been authorized by the board and will be started at once, according to report. The plant is expected



Surface plant of the Hecla Mining Co. at Burke, Idaho

to begin the production of concentrates by July 1. The first unit will be of 40 tons, but the capacity will be doubled as soon as the plant becomes efficient.

The mill equipment will include a crusher, a ball mill, flotation, and separation on tables, and a ratio of concentration is expected to be 6 to 1. Twelve to fourteen men are employed.

Johannesburg Letter

By John Watson
Special Correspondent

Rand Mines Increasing Use of Electrical Equipment

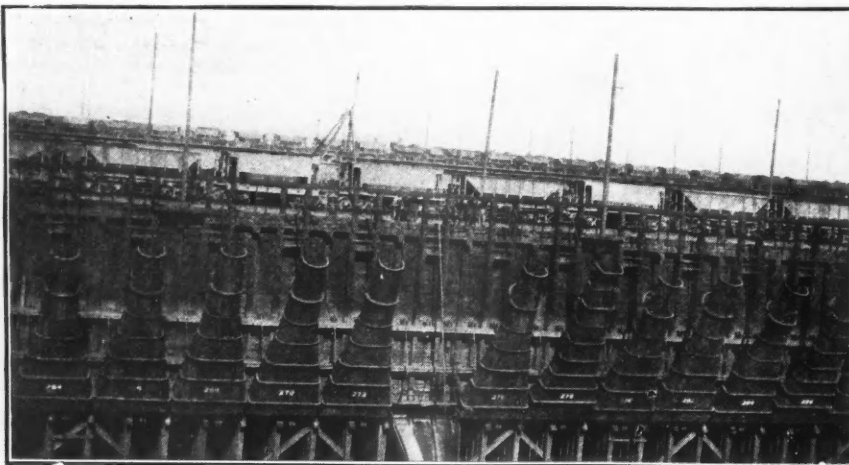
Modern-Type Winders and Hoists Efficient at Great Depths—London
Buying Platinum Shares

Johannesburg, March 4—H. W. Clayden, the new president of the South African Institute of Electrical Engineers, addressing the members on Feb. 20 said in part: "Some of the largest

electric winding plants in the world are working on the Rand today, notably the two 5,000-hp. Ward-Leonard winders at Randfontein, hauling from a depth of 5,000 ft. The maximum winding speed of these hoists is 4,000 ft. a minute. For underground, subincline, or subvertical hoists, electricity has made deep-level mining possible, which, thirty years ago, would have been unattainable, with compressed air as the only available power supply."

The Gold Producers' Committee of the Transvaal Chamber of Mines has written to the Secretary of Labor, informing him that the committee is unable to adopt the recommendations of the report of Judge de Villiers for reasons which were given during the sittings of the Conciliation Board. These are embodied, again, in a letter signed by the general manager, (W. Gemmill), which is published in the press.

The government returns of alluvial diamonds produced in the Transvaal during January show that 1,774 diggers were working. This is 353 fewer than in the previous month. Those who reg-



Iron-ore docks at Duluth. The cars have a capacity of 60 tons and the dock is long enough to accommodate 100 cars

British Columbia's 1924 Metal Production Valued at \$48,600,000

THOUGH the annual report of the Minister of Mines has not yet been published, he has given out the following as the mineral output of British Columbia for 1924. The total value of the output is placed at \$48,621,097. The following is the metal output:

Metal	Quantity	Value	Increase
Placer-gold, os.	21,037	\$420,750	\$750
Lode gold, oz.	233,142	4,819,045	1,114,050
Silver, oz.	8,341,169	5,291,804	1,573,675
Copper, lb.	64,845,393	8,442,870	119,604
Lead, lb.	170,384,481	12,415,917	6,094,147
Zinc, lb.	79,130,970	4,266,741	987,838

The coal output, 1,987,533 tons compared with 2,453,223 in 1923, was the only mineral to show a decrease, which the Minister attributes to the keen competition it receives from fuel oil.

istered finds numbered 1,203 and the total value of the diamonds found reached £92,721. The average value of the month worked out at £52 5s. per digger working, or £77 5s. each for those registering finds.

The Johannesburg Stock Exchange, during the past two days, has been the scene of excitement such as has not been witnessed since the "Sally" (S. A. Lands) boom, about twenty years ago. The boom now is in land development and platinum companies, consequent on the recent discovery of platinum over a large area to the north of Lydenburg. Transvaal Consolidated Lands shares were selling last November at prices ranging between 22s. to 25s. Two months later, their price had risen to 33s. 6d. When the Stock Exchange closed last Saturday, Feb. 28, the closing price for T.C.L. shares was 45s. 6d. Cables are said to have arrived over the week-end, from London and Paris. Before the doors of the Exchange were opened on Monday, the buying of platinum stocks had begun, and it is said that 20,000 T.C.L. shares changed hands before the close. The price rose from 45s. 6d. on Saturday to 55s. on Monday morning. So great was the excitement, among the public, that when the exchange opened on Monday, the gallery was crowded with visitors of both sexes. The total capital of the Transvaal Consolidated Lands is £465,119 in 10s. shares. To the older members of the Stock Exchange, the present boom is reminiscent of the gold booms of the 80's and 90's. Transvaal Development shares rose from 25s. 6d. on Saturday to 30s. 6d. on Tuesday, March 3. These are called for by the brokers, as "Devels."

Control of Alice Mine Bought

O. C. Thompson, mine superintendent for Porcupine Goldfields' operations at the Stewwinder and North Star mines, near Kimberley, B. C., has purchased a controlling interest in the Alice mine, 3 miles from Creston and 1 mile from the Canadian Pacific Ry. Whether this has been acquired for personal or for the Goldfields' interests is not known.

The mine was worked for five years in the early days of mining by an English company, which erected a mill and an aerial tramway. It is stated that the mill failed to give a satisfactory recovery and consequently the mine was closed. Later, it was worked for a short time by local people. The property is said to contain a strong vein of silver-lead ore, on which two shoots have been developed. Mr. Thompson has cleaned out the old tunnels and has also started a raise from the bottom tunnel.

Washington News

By Paul Wooton
Special Correspondent

High Grade Manganese Ore Wanted for Radio Sets

Government Search Being Made to Produce Needed New Supplies—
African Gold Coast Potential Producer

A critical situation has arisen in the manganese trade. The U. S. Department of Commerce has been called upon to lend its aid in the world-wide search for more manganese ore of chemical grade. The increasing use of storage batteries in connection with radio has created a demand for this form of manganese which is being met with the greatest difficulty. The recent destruction by fire of the surface improvement of the Lavino manganese property, in Montana, has made the immediate situation more acute. This leaves the principal source of domestic supply in the hands of one company. The output of the mine, however, is not sufficient for its needs, even though it is not a large consumer, so the demand continues unsatisfied.

The Gold Coast of Africa recently has become a large producer of manganese of metallurgical grade. Advances which just have reached the Department of Commerce indicate that no less than 300,000 tons of ore of shipping grade will be produced there in 1925. It is claimed that ore of chemical grade also is present. This is being investigated.

Because of the lack of knowledge as to the particular property which makes manganese valuable for battery use it is necessary to observe its action in use. This makes for long delay and adds greatly to the difficulties of the mining engineers who are in the field in all parts of the world.

A plan now is taking form looking to exhaustive experimentation in the hope that a means may be devised whereby the manganese possessing the right sort of electrical property can be recognized promptly. This work, however, holds little promise in the present emergency.

The properties of chemical manganese are imperfectly understood. That problem will have to be solved first. It has baffled chemists and electricians thus far, but the work has been rather desultory.

Humboldt Smelter to Remain Closed Temporarily

OWING to the falling price of copper and the lack of sufficient custom ore at this time to make smelting profitable, the Southwest Metals Co. did not resume operations at its smelter at Humboldt, Ariz., on April 1 as had been expected. Development of the company's mine at Bluebell, in the Mayer district, will be continued, and some custom ore will be bought and stored until the reopening of the smelter, which it is hoped will occur some time during the summer.

Magnesite Tariff Investigation to Study Value of Imports

As a step in its further investigation of magnesite, the Tariff Commission will secure the declared values on imports. The great expense involved in the making of investigations abroad is leading the commission to give greater consideration to the record of declared values. If it can be shown that the declared value of an imported community is less than the cost of pro-



Sampling plant of the Miami mill
at Miami, Ariz.

duction of the commodity produced in the United States, plus the duty and the 50 per cent increase which can be allowed, there would be no occasion to go into the matter of foreign costs, as it is evident that relief could not be provided under the existing law.

With respect to magnesite, however, it is not a foregone conclusion that the full 50 per cent increase should be applied. Apparently the foreign investigation is going to be necessary.

The limitation which is put on foreign investigations by the amount of

money the commission can devote to such a purpose has given rise to the suggestion that the interests to benefit should have an opportunity to furnish money on a co-operative basis. It is pointed out that the Bureau of Standards and the Bureau of Mines extend their usefulness very greatly through their co-operative arrangements.

Charcoal Iron Producers Want a Higher Tariff

Producers of charcoal iron contend that they are being put out of business by importations of that product. They want action taken in their behalf under the flexible provisions of the tariff act.

From such knowledge as is available as to the cost of making this type of iron abroad, it would seem that the tariff act cannot furnish the relief these producers must have if they stay in business. The duty on pig iron is 75c. a ton. The full 50 per cent of increase would raise the duty to only \$1.12½. The difference between domestic and foreign costs is so much more than 37½c. that the situation would not be changed by that small increase.

All of the producers affected are east of the Alleghanies. Their operations are on a small scale. In addition to foreign competition, this industry is suffering from a diminishing demand for its product. Horseshoe nails and other articles made of charcoal iron are being used in less quantities, and blast-furnace iron is encroaching more and more on the market of these producers.

Bond Trout Lake Properties

A syndicate of prominent Kootenay mining men has bonded the Silver Cup mine and Nettie L. group, in the Trout Lake district of British Columbia. In the early part of the century the Silver Cup was the best silver-lead producing mine in the district. A concentrator was erected, which was ineffective, and then the war came and the mine was closed. Except for a small shipment of high-grade silver-lead ore in 1921, the mine has been closed since 1914. The property will be reopened, and, if development warrants, a modern flotation plant will be erected.

Miami Copper Pays 25c. Dividend

The Miami Copper Co. has declared a quarterly dividend of 25c., payable May 15 to stock of record May 1. Prior to this, the dividend had been 50c. quarterly.

After the declaration of the quarterly dividend, the company stated:

"In view of the increased costs anticipated because of the lower grade ore which will shortly be treated as set forth in the annual report recently issued, the directors considered it the conservative and better business policy to reduce the dividend to 25c."

Hewer Mining Co. Active

The mine and mill of the Hewer Mining Co., operating five miles south of Lakeview, Idaho, are being operated on a continuous basis, according to Daniel M. Drumheller, of Spokane, manager. Shipments are proceeding to the Bunker Hill smelter and the ore brings about \$2,000 net to the carload.

Societies, Addresses, and Reports

Refractories Program Announced

First Meeting of Newly Organized Institute Set for April 14

The American Refractories Institute, the formation of which was recently announced, will hold its first regular meeting on April 14 at 9.30 a.m. in Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh, Pa. After a short business session, the following program of addresses and events is scheduled:

Morning Session

Address on "The Value of Research in Industry," by Dr. E. R. Weidlein, Director, Mellon Institute.

A practical discussion of "The Use of Refractories Materials," by H. L. Dixon, president, H. L. Dixon Co., Pittsburgh.

Address on "Refractories Accounting," by A. J. Farber, Haskins & Sells, Pittsburgh.

A discussion of "Spalling," by M. C. Booze, senior industrial fellow, Mellon Institute.

A discussion of "Relation of Structure and Composition of Refractories to Thermal Efficiency in Regenerators," by S. M. Phelps, industrial fellow, Mellon Institute.

Inspection of laboratories of Mellon Institute.

Luncheon at University Club, Natalie Place, Pittsburgh.

Afternoon Session

Address on "The American Refractories Institute," by J. D. Ramsay, president, Elk Fire Brick Co., St. Marys, Pa.

Unfinished business.

As previously announced, anyone interested in the manufacture or use of refractories is urged to attend this meeting, regardless of his affiliation with the new organization.

Zinc Institute's Meeting Drawing Near

It is expected that a good-sized delegation from the Joplin-Miami district will attend the annual meeting of the American Zinc Institute, to be held at St. Louis on April 27 and 28. The different organizations of mine operators in the field are doing what they can to stimulate interest in the meeting, with the hope of bringing about a larger attendance than ever before.

About thirty-five mine operators and supply men participated in the annual fishing trip to Lake Taneycomo, Mo., the latter part of March, and reported a splendid time. They remained two days, and only two fish were caught, according to the official report.

Nelson Chamber of Mines Organized

A chamber of mines for eastern British Columbia was organized at Nelson on March 21, when the following provisional officers were elected: President, Judge J. A. Forin; secretary, E. G. Matthews; and treasurer, W. S. King.

American Institute Arranges Exposition of Inventions

The story of invention, from the dawn of civilization to the "day after tomorrow," with exhibits and demonstrations to illustrate, will be told at the forthcoming Exposition of Inventions at the Engineering Societies Building in New York City. Throughout a week at the end of April, inventors, research engineers and chemists, and men who have had much to do with the development of inventions, will unite in telling the many chapters of this marvellous story.

The American Institute of the City of New York, now in its ninety-seventh year of service to American industry, is arranging the exposition as its ninety-fourth annual showing of American progress. To bring together this far reaching field it has enlisted the co-operation of the engineering societies, commercial organizations, and individual authorities, each for the purpose of telling about inventions in specific fields.

The American Institute initiated this work for invention as long ago as 1835, at which time it was instrumental in the organization of the Patent Office, and the Exposition of Inventions is a feature of its work for the present day inventor.

Geological Congress Postponed

The date for the next International Geological Congress, which was originally announced for Madrid in 1925, has been changed to Madrid in the spring of 1926. More definite notices of exact dates are not yet available. The change was necessitated by the extreme heat of the summer months.

Next Chemical Industry Show Announced

The growing importance of the chemical industry to the economic life of the nation will be emphasized at the Tenth Exposition of Chemical Industries to be held during the week of Sept. 28-Oct. 3, 1925, at the Grand Central Palace, New York. Plans are already under way to have this exposition embody the essential features of the present status of the industry. The latest developments in production methods and the most efficient equipment are to be there for inspection, as incentives to progressive manufacturers for new ideas on the manufacture of the raw materials into finished products. Applied chemistry and engineering, in view of improving the quality, increasing the production, and lowering the cost to meet competition, will constitute one of the dominant notes.

Since 1915, when the first exposition of chemical industries was held, much has been learned regarding the best means to give real service to exhibitors and visitors; the subsequent eight expositions have shown clearly the normal progressive steps followed in this direction. The tenth exposition will be under the same management.

Economic Geologists to Visit Cornwall, Pa.

The annual meeting of the Society of Economic Geologists will take place at Room 305, Schermerhorn Hall, Columbia University, New York, on May 27. Technical sessions will be held at 10 a.m. and 2 p.m. That evening the members of the society will entrain for Lebanon, Pa., and Saturday, May 23, will be spent in a field trip to Cornwall ore deposits.

Tuolumne Mining Society Organized

A new organization, the Tuolumne Mining Society, has recently been formed. On March 26 it met at Sonora, Calif., on the Mother Lode. William R. Gillis was elected honorary chairman, O. McCraney, manager of the Shawmut mine, chairman, and W. J. Woolsey, secretary. Lindley M. Reith, Fred Sutton, G. P. Morgan, C. E. Shafer, N. C. Hughes, and H. J. Coffill were appointed to serve on the executive committee.

It is intended to have speakers at the meetings who will talk on various phases of mining, in an effort to help the industry. The opinion of those present was that Tuolumne County has ample resources in metallic and non-metallic minerals awaiting capital to develop them.

The newly elected honorary chairman, W. R. Gillis, is a brother of "Truthful James" Gillis, one of the characters in Mark Twain's "Roughing It." He is a picturesque figure now, living in Mark Twain's cabin at Jackass Hill.

Coming Election and Lecture of Institute of Metals

On April 22 an election of new members and students of the Institute of Metals will be held in London. Particulars can be obtained from the secretary, G. Shaw Scott, 36 Victoria St., S.W.1. The dues of persons then elected will cover not merely the usual period of twelve months but also the extended period ending June 30, 1926.

The election is arranged in connection with the Fifteenth Annual May Lecture, which is to be given by Prof. H. A. Lorentz, of Leiden, Holland, on May 6, tickets for which can also be obtained from Mr. Shaw Scott. The subject of the lecture is "The Motion of Electricity in Metals."

Utah Chapter of Mining Congress Elects Officers

At a recent meeting of the Utah Chapter of the American Mining Congress the board of directors elected the following officers: E. J. Raddatz, (re-elected) governor; George W. Lambourne, first vice-governor, and Imer Pett, second vice-governor. H. M. Hartman was re-elected third vice-governor, and A. G. Mackenzie secretary and treasurer.

The following were elected to the executive committee: Mr. Raddatz, Mr. Cates, Mr. Lambourne, D. D. Muir, and Mr. Pett.

Men You Should Know About

Charles Butters recently left Cobalt to go to New York City en route for Colombia.

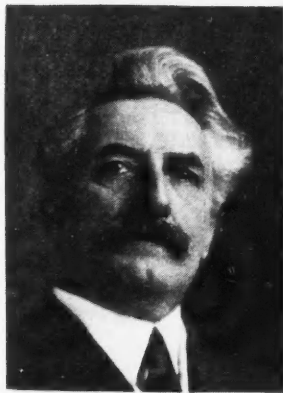
Edward B. Sturgis, assistant editor of "The Mines Handbook" during the past four years, has resigned from this position.

Morton Webber recently arrived in New York from a business trip to Paris and London, and left immediately for California.

J. C. Pickering has resigned from the El Oro Mining & Railway Co., of Mexico, and allied concerns and has returned to New York.

R. K. Neill, a prominent mining man of British Columbia and pioneer in the development of the Premier mine, is visiting Toronto.

J. H. Lang, of the American Metal Company, Ltd., who went to Miami, Fla., several weeks ago because of ill health, has returned to New York.



J. A. Ede

J. A. Ede has recently returned from one of his periodical visits to the Missouri, Kansas, and Oklahoma zinc fields with which he has been in close touch for more than twenty-five years.

D. W. Brunton, consulting mining engineer, of Denver, Colo., has gone to Pachuca, Mexico, and expects to return via Vera Cruz and New York.

Thomas M. Owen, of Wallace, Idaho, former assistant manager of the Federal Mining & Smelting Co., is en route for Sydney, Australia, his former home.

B. C. Yates, superintendent of the Homestake Mining Co., at Lead, S. D., who has been spending a vacation of six weeks in Florida, has returned to Lead.

Edgar De Golyer, vice-president and general manager of the Amerada Petroleum Corporation, has been elected president of the American Association of Petroleum Geologists.

V. C. Clauson, mill superintendent of the Alaska Juneau Gold Mining Co., has gone to Juneau, Alaska, after a trip during the course of which he made a study of a number of concentrating plants.



W. J. Loring

W. J. Loring has accepted the presidency and office of managing director of the Cincorcio Minero Guanajuato, S. A., one of the largest mining companies in Mexico, and has left San Francisco for his new post, accompanied by Mrs. Loring, to whom he was married last month.

J. Louis Van Zelm, vice-president of the Bank of New York and Trust Co., was on April 1 elected to the board of directors of the American Smelting & Refining Co., succeeding Wilfred Shore, who died recently.

Leon W. Dupuy has resigned his position as statistician for open-pit operations at the Copper Queen, at Bisbee, Ariz., to become mine engineer for the Cananea Consolidated Copper Co., at Cananea, Sonora, Mexico.

H. C. Boydell, of the Department of Geology of the Massachusetts Institute of Technology, on April 2 began a course of eight lectures on "Colloidal Chemistry Applied to Geology" at the above-named institution.

H. H. Hunner, formerly with the Mesabi Iron Co., at Babbitt, Minn., has been appointed general foreman on one of the three eight-hour shifts at the mines of the Ray Consolidated Copper Co. in Santa Rita, N. M.

C. A. Banks, manager for the Selukwe Gold Mining & Finance Co., which owns the B. C. Silver mines, in the Salmon River district of British Columbia, was recently in San Francisco on a short business trip.

R. F. Manahan has resigned his position as assistant general manager of the Mining Department of Mexico, of the American Smelting & Refining Co. and its subsidiaries, and will take an extended vacation in California.

A. D. Akin, interested in the Taviche and other mining camps in Oaxaca, Mexico, has returned to Oaxaca from the American Hospital at Mexico City, where he was treated for injuries received Feb. 3 from a random bullet.

W. J. Walmsley, general manager of the Rock Products Co. of Nevada, addressed the Crucible Club of the Mackay School of Mines, at Reno, Nev., recently on the subject of the importance of non-metallic mineral products.

T. Parker Kerby, secretary of the Selkirk Gold Mining Co., has returned from the mine in the Hole River district of Manitoba, where he has been wintering, and is in Winnipeg awaiting orders from headquarters in New York.

Albert Burch, mining engineer, of San Francisco, on April 1 removed his office from that city to Black Oak Ranch, Medford, Ore. He will still maintain connection with the firm of Burch, Hershey & White, of San Francisco.

Harvey H. Cluff, Attorney General of the State of Utah, and an experienced mining man, is making an inspection of the property of the Grand View Mining & Milling Co. situated in the Pinus Altos district about 6 miles north of Silver City, N. M.

Arthur W. Jenks, of Berkeley, Calif., arrived in New York this week after a brief visit in Arizona. He is on professional business, and will remain about two weeks. Opinion in Arizona, he says, is distinctly favorable regarding the new Calles government in Mexico.



Thomas King Muir

Thomas King Muir left El Paso, Tex., on April 2, in the interest of certain operators, to make a preliminary examination of certain acreage in Torrance and De Baca counties, in New Mexico. He expects to spend ten days or two weeks in this work.

A. C. H. Gerhardi, managing director of the Consolidated Homestake Mining & Development Co., Ltd., operating at Alice Arm, B. C., Canada, recently stopped in New York on his way to England, where he expects to interest additional capital for development of the Toric mine, at Alice Arm.

Ira L. Wright, general manager of the Black Hawk Consolidated Mines Co., is in Milwaukee attending a meeting of the directors of the company to consider the plans for installing additional equipment for extending development of their holdings in the Hanover-Fierro (New Mexico) district.

Fernando Montijo, Jr., has resigned from the Moctezuma Copper Co. to assume the post of "Responsible Engineer" with the Cananea Consolidated Copper Co. The term "Responsible Engineer," implies registration in Mexico in accordance with the provision of the new Mexican federal mining law.

Recent Technical Publications

Reviews, Abstracts, and References

Assay Work and Chemical Control

Textbook of Rand Assay Practice.
Edited by Dr. James Moir and Prof. G. H. Stanley. South African Association of Assayers, Johannesburg, South Africa.

The practice of assaying is closely linked with the practice of analytical chemistry, and it is evident that an assayer must be a chemist. An insight into the control methods in vogue at one of the largest chemico-metallurgical centers—Transvaal, South Africa—is of more than ordinary interest. The profession of assaying there, as elsewhere, has survived the competition of the crook and the charlatan. "A more critical comparison of actual gold recovered, as compared with theoretical extraction results, and a closer scrutiny of residue values, together with improved metallurgical processes, led to a realization of the importance, and indeed the vital necessity, to the gold-mining industry, of being assured of reliable and precise assay-value reports . . ." A Certificate of Competency in assaying is issued by the government after successful examination, and compulsory registration is looked upon as ultimately inevitable. The South African Association of Assayers, in co-operation with the South African Chemical Institute, produced the volume under review. Not fewer than forty-six prominent chemists, assayers, and metallurgists have contributed, and the result is a significant addition to the literature of the subject. Although primarily designed for the inspiration and guidance of South African technicians, it will be found of considerable value to all who are concerned with the assaying of ores and bullion; the treatment of byproducts; the sampling and estimation of the components of air, fumes, and dust; the treatment and analyses of waters and oils; the chemical control of working solutions and the analyses of stores and raw materials. A feature of the book is the inclusion of many novel time-saving, checking and control devices, for the increase of output and the prevention of error. The misplacement of cupels during handling to and from the furnace has led to many a mistake in recovery results. Graphic details are given of the double copper-stain method, whereby an accidental alteration from the correct sequence is immediately discernible. The design and equipment of the assay office and laboratory is discussed in preliminary chapters, including provision for dust control. A discussion of practice follows. Gas, air, and oil analysis is described and illustrated, and methods are outlined. The determination of metal content of ores and byproducts is discussed at length. Solution control methods are outlined. The analysis of raw material is given adequate attention. Several plates are appended, illustrating the ingenuity of the assayer, accompanied with short descriptions of practical value. A flux-mixing barrel; racks for molds and traveling trays for

crucibles; a transferrer for cupels; a novel system of "unmistakable" weights; a sample press; electrical driers; indicators to obviate giving verbal instructions; time-saving expedients in chemical analysis; compressed-air cupel machine; mixing and quartering apparatus—this list indicates a few of the ideas that will find acceptance elsewhere. Tables and formulæ complete the volume, which is interleaved with plain paper for personal notes.
A. W. ALLEN.

Metal Statistics

Quin's Metal Handbook and Statistics, 1925. Compiled by L. H. Quin. The Metal Information Bureau, Ltd., 79 Mark Lane, London, E. C. 3, England. Price, 5s.

The new edition of this valuable handbook, containing data for 1924 and preceding years, has recently been published. The daily prices of the metals sold on the London Metal Exchange during 1924 are given, as well as a large amount of other statistical information of interest to producers, sellers, and users of metals.

Coal and Civilization. By E. C. Jeffrey, Ph.D. The Macmillan Company, New York. Price \$2.50.

This is a really excellent book which we can highly recommend. It is a clear, concise and interesting scientific discussion of the origin and structure of coal, which is the most illuminating that we have seen. This, however, is put so well that it should be of interest to the cultured general reader, for it is stripped of all unnecessary pedanticisms.

To all this Professor Jeffrey has added some philosophical considerations of still more popular interest, so that the work begins with two chapters on "Coal and Civilization" and "The Coal Age and Other Ages," and ends with a chapter on the "Duration of Coal and Petroleum." Altogether the book is an excellent example of a contribution to popular science, with an interesting leaning toward political and commercial geology.
J. E. SPURR.

Letters from India. By Owen Letcher.

Published by Central News Agency, Ltd., Johannesburg, S. A. Price, 3s. This collection of travel articles from the pen of a mining engineer proves that some mining engineers possess the gift of colorful writing. Indeed, it would be difficult to find a more sensitive appreciation of the beauty and mystic charm of India or a more vivid and interesting narrative of a trip through that country.

A Tested Method of Laboratory Organization. By Seymour Pile and Reginald Johnston. H. F. & G. Witherby, 326 High Holborn, London, W. C. 1, England. Price, 7s. 6d.

A short book covering a discussion of the building and arrangement of a laboratory, personnel, instruments, records, cost keeping, and the relation of the scientist to the world of industry.

Iron Mining—Volume 23 of the *Proceedings of the Lake Superior Institute*, Ishpeming, Mich. (price to non-members \$2 in paper covers), in addition to giving a list of the members and statistical data on operating mines of the Lake Superior district, includes the following papers: "Fire Prevention and Fire Fighting in Metal Mines," 13 pages, by Lucien Eaton and William Conibear; "Recent Developments in the Geology of the Gogebic Range," 9 pages, by W. O. Hotchkiss; "Surface Equipment for Iron Mines," 7 pages, by E. S. Bonnell; "Slushing Practice in the Mines of the Oliver Iron Mining Co.," 10 pages, by Ford E. Boyd; "The Wear and Care of Wire Rope," 7 pages, by William Constable; "Brief History of the Cuyuna Range," 6 pages, by J. Wilbur Van Evera; "Developments of the Use of Cuyuna Range Manganiferous Iron Ores," 6 pages, by L. E. Ives; "Guniting in the Athens Shaft," 8 pages, by C. W. Nicolson; "Mesabi Iron Co.'s Reduction Plant," 19 pages, by W. G. Swart; "Safety in Electrical Installations in Mines," 17 pages, by F. C. Stanford; and "Unloading and Sampling Ore at Lower Lake Ports," 8 pages, by C. P. McCormack and C. C. Walsh.

Tin Mining and Metallurgy—The *Bulletin of the Institution of Mining and Metallurgy* for February contains an 8-page paper by A. L. Simon and R. O. Simon, "Notes on Tin Recovery and Tin Dressing," (price 1s.) and a 25-page paper by L. G. Attenborough on "Tin Mining in Malaya," with discussion.

Bismuth—The Imperial Institute has issued a 62-page bulletin by Robert Allen on "Bismuth Ores," giving their occurrence, character, and uses, with a discussion of sources of supply throughout the world. Obtainable for 3s. 6d. from John Murray, 50A Albermarle St., London, W. 1, England.

Electrical Prospecting—The *Journal of the Chemical, Metallurgical and Mining Society of South Africa*, for November, 1924, has an 11-page paper by G. Bergström on "Electrical Prospecting," describing the Schlumberger method and a Swedish modification. Price 3s. 6d.; Johannesburg.

Quebec Gold—The Canadian Department of Mines, Ottawa, has issued Bulletin No. 20 in the Memorandum series, 8 pages, describing the new "Goldfields of Northwestern Quebec." The development work so far done is outlined and the methods of ore treatment are suggested. W. B. Timm and A. H. A. Robinson are the authors, and the bulletin is obtainable on request.

Antimony—A bulletin of 102 pages on "Antimony Ores," by Edward Halse, has been issued by the Imperial Institute. The occurrences, character, uses, and methods of reduction are first outlined and then the deposits in various parts of the world are described. Price 5s. from John Murray, 50A Albermarle St., London, W. 1, England.

Explosives—"Safety in the Use of Explosives," a paper by N. S. Greensfelder presented at the meeting of the National Safety Council at Louisville, has been reprinted as a 75-page bulletin for free distribution by the Hercules Powder Co., Wilmington, Del.

Mineral Statistics—The Imperial Mineral Resources Bureau has issued the following bulletins giving world statistics of production, imports, exports, and prices for the years 1920, 1921, and 1922: "Quicksilver," 22 pages, 1s. 1d.; "Manganese," 29 pages, 1s. 4d.; "Bismuth," 15 pages, 6½d.; "Asbestos," 23 pages, 1s. 1d.; "Tin," 42 pages, 2s. 1d.; "Copper," 65 pages, 2s. 7d.; "Graphite," 23 pages, 1s. 1d.; "Arsenic," 24 pages, 1s. 1d.; "Abrasives," 26 pages, 1s. 1d.; "Cobalt," 15 pages, 6½d.; "Barium Minerals," 24 pages, 1s. 1d.; "Fluorspar," 11 pages, 6½d.; "Gold," 61 pages, 2s. 1d.; and "Statistical Summary," including all metals and minerals covered in the separates, 304 pages, 8s. 4d. Copies may be obtained from the British Library of Information, 44 Whitehall St., New York City.

Recent separates of "Mineral Resources of the United States, 1923," include: "Gold, Silver, Copper, Lead, and Zinc in Montana," 32 pages, by C. N. Gerry, and "Natural-gas Gasoline," 6 pages, by G. B. Richardson. Obtainable on request from the U. S. Geological Survey, Washington, D. C.

Sponge Iron—"The Production of Sponge Iron" is discussed by Clyde E. Williams, Edward P. Barrett, and Bernard M. Larson in U. S. Bureau of Mines *Reports of Investigations* Serial No. 2656, 14 pages, obtainable on request from the Bureau at Washington. The report covers experimental work on a furnace of the rotary kiln type, carried on at the Northwest Experiment Station, and at the plant of the Tintic Milling Co., Silver City, Utah, where three tons a day was made.

Geology—Professional Paper 134, U. S. Geological Survey, discusses the "Upper Cretaceous and Tertiary Formations of the Western Part of the San Juan Basin, Colorado and New Mexico," 70 pages, by John B. Reeside, Jr. Obtainable for 40c. from the Superintendent of Documents, Washington, D. C. Bulletin 751-D, by Hugh D. Miser, 40 pages, discusses the "Geologic Structure of the San Juan Canyon and Adjacent Country, Utah." Obtainable on request from the U. S. Geological Survey, Washington, D. C.

Mine Ventilation—"Experiments on the Flow of Air in Mines," 15 pages, by D. Penman and J. S. Penman, appears in the *Transactions of the Mining Institute of Scotland*, Vol. XLV, Part 3, Glasgow, Scotland. Tests in straight tubes, orifices, and bends were carried out.

Idaho Geology—Pamphlet No. 11, 56 pages, issued by the Idaho Bureau of Mines and Geology, Moscow, Idaho, is a discussion by Arthur M. Piper, of the geology and water resources of the Bruneau River basin. Owyhee County, Idaho.

Rochester, Nevada—"Geology and Ore Deposits of the Rochester District, Nevada," is the title of a 78-page report by Adolph Knopf, published by the U. S. Bureau of Mines as Bulletin 762, and obtainable for 15c. from the Superintendent of Documents, Washington, D. C. Rochester is a silver-mining district in the Humboldt Range of western Nevada.

Patents

Patents Issued in 1924—The United States Patent Office, Washington, D. C., has issued a book of 1,731 pages indexing all patents and registrations granted during 1924.

Fuller's Earth—No. 1,524,843. Feb. 3, 1925. C. C. Ruprecht, Olmstead, Ill. A process of preparing fuller's earth comprising drying it to free it from hygroscopic water, then saturating it with a colloidal solution, removing a portion of such solution, and drying the earth.

Miner's Cap—No. 1,525,030. Feb. 3, 1925. E. N. Galanis, New York City. A miner's safety cap designed to protect the wearer from injurious contact with electric wires.

Zinc Refining—No. 1,525,703. Feb. 10, 1925. Filip Tharaldsen, Christiania, Norway. An electric furnace for refining zinc, comprising melting and distillation chambers, with a connecting passage whose cross-sectional area may be varied for the purpose of regulating the temperature in the melting chamber.

Metallurgy of Tin—No. 1,526,571. Feb. 17, 1925. Elias Anthon Cappelen Smith, New York City. A process of recovering tin from low-grade material comprising subjecting the material to a gaseous reducing agent to reduce the compounds of tin, the tin then being dissolved and electrodeposited.

Amalgamator—No. 1,526,915. Feb. 17, 1925. D. C. Kuffel, Los Angeles, assignor of one-third to W. H. Williams, and one-third to E. A. McNeer, Los Angeles. Design for an amalgamating apparatus.

Centrifugal Concentrator—Nos. 1,527,072-3-4-5. Feb. 17, 1925. Orrin B. Peck, Jr., Los Angeles. Designs for centrifugal separators for concentrating ores.

No. 1,527,076. W. H. Peck, Los Angeles. A centrifugal separator adapted to the treatment of fused material having metal-bearing constituents.

Drill—No. 1,528,812. March 10, 1925. Robert Binnie, Bolivar, Pa. Design for a rotary reciprocating hammer drill.

No. 1,525,020. Feb. 3, 1925. L. C. Bayles, Easton, Pa., and G. G. Tuttle, Phillipsburg, N. J., assignors to Ingersoll-Rand Co., Jersey City, N. J. A water tube for rock drills.

No. 1,526,565. Feb. 17, 1925. J. E. Redmond, Butte, Mont., assignor of 49/100 to W. C. Siderfin, Butte, Mont. Design of a drill bit.

Screening Devices—No. 1,529,370. March 10, 1925. Gus Nelson, Douglas, Ariz. A revolving screen bar device, operating in a hopper, with a movable baffle plate on which the feed drops.

Sample Grinder—No. 1,529,961. March 17, 1925. Edward Murphy, Cle Elum, Wash. A cylindrical ore-sample grinder, using disks as the grinding medium.

Flotation Reagent—No. 1,530,496. March 24, 1925. R. M. Isham, Okmulgee, Okla., assignor to Seth B. Hunt, trustee, Mount Kisco, N. Y. The patent covers the manufacture of a mixture of polymerized olefines and diolefines, secondary and tertiary alcohols, and alkyl hydrogen sulphate.

Zinc Smelting—No. 1,529,752. March 17, 1925. C. M. Stein, Paris, France, assignor to Société Anonyme des Appareils de Manutention et Fours Stein, Paris, France. A non-reversing chamber furnace for distilling zinc from ore.

No. 1,530,919. March 24, 1925. J. D. Thomas, Pueblo, Colo., assignor to American Smelting & Refining Co., New York City. A machine for charging bullets of zinc ore to retorts, steam under pressure being used to keep the bullets separate.

No. 1,530,154. March 17, 1925. Fritz Caspari, Gelsenkirchen, Germany. A cylindrical rotary chamber for condensing zinc or other volatile metal vapors.

Reverberatory Smelting—No. 1,530,754. March 24, 1925. H. L. Charles, Kent, Wash. A method of smelting which consists in directing a smelting flame from the burner through a passage in a quantity of ore in the furnace.

Chute Gate—No. 1,531,116. March 24, 1925. J. R. McGiffert and O. L. Berby, Duluth, Minn., assignors to Clyde Iron Works, Duluth. Design of a gate for ore chutes.

Tempering Furnace—No. 1,531,214. March 24, 1925. D. S. O'Donovan, Vogelfontein, Transvaal, South Africa, assignor to O'Donovan Furnaces, Ltd., Johannesburg. A furnace for heating drills, comprising a horizontal flue and a series of open-ended muffles.

Potash Recovery—No. 1,531,336. March 31, 1925. B. F. Halvorsen, Christiania, H. J. Falck, Notodden, Thor Mejdell, Skoien, and Oystein Ravner, Christiania, Norway, assignors to Norsk Hydro-Elektrisk Kvaestofaktieselskab, Christiania. Leucite is dissolved in dilute nitric acid, the solution neutralized, evaporated, and cooled, so that mixed crystals of potassium nitrate and aluminum nitrate are precipitated.

Drier—No. 1,531,438. March 31, 1925. W. A. Harty, Blasdel, N. Y., and Frank W. Moore, Thorold, Ont. A rotary drier equipped with a screen at one end and an internal heating pipe rotating with the shell.

No. 1,531,780. March 31, 1925. F. T. Greaves, Chicago. A rotary drier made of sheet metal with longitudinal fins.

Gold Dredge—No. 1,531,477. March 31, 1925. C. B. Dawson and C. B. Dawson, Jr., Seattle, Wash. Design for a submarine dredge for placer gold mining.

Sintering—No. 1,531,695. March 31, 1925. F. A. Eustis, Milton, Mass. Fine material is sintered in successive charges, the heat remaining after sintering being used to heat succeeding charges.

Petroleum—No. 1,531,697. March 31, 1925. R. F. Hopkins and O. F. Devolld, Bartlesville, Okla. An oil-well pump.

No. 1,531,802. March 31, 1925. D. H. McCray, Tulsa, Okla. An oil-well jack.

Roasting Furnace—No. 1,531,791-2. March 31, 1925. L. R. Kelley, Bethlehem, Pa., assignor to Bethlehem Foundry & Machine Co. These patents cover a method of joining the arches to the shaft, with passages for the ore, in multiple-hearth roasting furnaces of the Wedge type.

New Machinery and Inventions

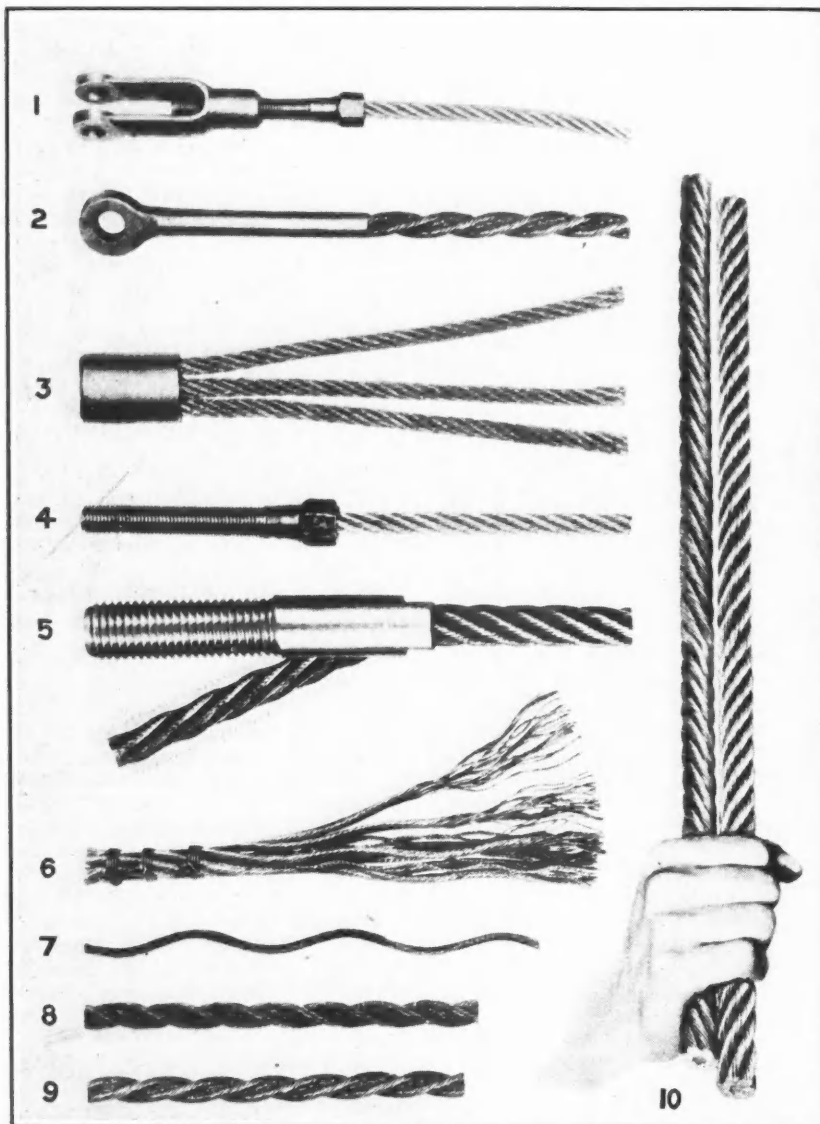
An Improved Wire Rope for Mine Use

Of interest to engineers with mine hoisting and haulage problems is the recent announcement by the American Cable Co. of a new wire rope, known as Tru-lay, embodying in its construction what the maker claims is a basic improvement over previous methods of manufacture. A new principle is involved, consisting in the "preforming" of wires and strands to the exact shape they must have to fit correctly in the completed product. The rope is being made in Lang and regular lays up to 1 in. in diameter. Engineers who have been concerned with its development for mining purposes express their satis-

faction with its performance under tests.

The rope resists unstranding. It can be cut at any point for splicing and otherwise handled without the necessity of seizing. Tests are said to show that it has a longer life than ordinary rope under reversed bending stresses—an important asset where winding over sheaves and drums is a chief cause of wear.

The "preforming" of the wires and strands in the rope results in evenly balancing the load on individual strands and is a remarkably uniform load distribution to single wires. The rope shows no tendency to high strand in actual use and has stood up satisfactorily in tests under heavy loads.



A new wire rope and a fitting of special design

1. Tru-lay rope with a threaded hexagon Tru-loc fitting permitting the application of shackle as shown, or turnbuckles, rods, etc. 2. Flat head eye end fitted directly to rope. 3. Example of a multiple rope fitting of the new type. 4. Hexagon fitting intended to make wire rope as adaptable to various uses as rods. 5. Steel fitting of new type split open to show how metal grips strands and wires in the rope. Better equalization of load on wires and strands is said to be possible with this type of fitting. 6. How an ordinary wire rope unstrands when cut. 7. Strand of Tru-lay wire. Note how the strand is preformed to hold the exact shape it must take in the completed rope. 8. Perfect balance of strands is said to be obtained in rope of regular lay made on the new principle. Illustration shows length of rope with every other strand removed. 9. Length of Lang lay rope made on the new principle with every other strand removed. Although unseized the rope does not unstrand. 10. Graphic illustration of how the new rope can be cut and handled without seizing and without loss of shape.

Broken wires in this new rope lie flat. The outer wires show no tendency to fray out of the rope body. They continue in their places, thus lessening the wear on other wires and on sheaves and drums. The fact that the rope does not unstrand makes splicing a comparatively simple operation.

Rope users have long known that Lang-lay rope has advantages over regular lay for certain sheave and drum work. Though 80 per cent of mine cable used in England and Europe is Lang lay, it has been little used in the United States, because of difficulties in splicing and handling. The preformed principle in the new rope is designed to meet this difficulty, making the use of Lang-lay rope possible wherever desired.

To make available practically the entire strength of the new rope, the company has developed for it a special steel fitting, without zinc, called Tru-loc. This fitting has not only proved dependable under ordinary conditions, but also permits the use of turnbuckles, shackles, and other equipment used with rods and chains.

A steel sleeve is slipped over the smooth unseized end of the rope, placed in a specially designed press, and made to "flow" down upon the rope until it grips wires and strands. These sleeves may be of any reasonable length—can be threaded, can be equipped with heads of various types for wrenches, or furnished with eyes or hooks. The fitting is lighter and less bulky and has been found to be more dependable than the old-style zinc socket, probably because of the greater equalization of load on wires and strands.

Though particularly adaptable for mine-hoisting work, the new rope is designed for use in every industry where dependable wire rope is a factor.

Pulverizing Coal for Direct Firing of Boilers

About three years ago the Bonnot Company of Canton, Ohio, set out to develop a unit coal pulverizer to meet the demands of the modern boiler plant, which include continuity of operating and quick response to local demands, with the advantage of economically burning low-grade fuels in pulverized form. It seemed that the ball mill principle was the logical one for producing a unit pulverizer which would be dependable and economical for preparing coal for boiler firing. It is claimed that all of the basic principles on which successful ball mills have been designed are embodied in the "Unit-air" ball mill, recently announced.

To remove the finished product as rapidly as it was pulverized, the feature of "interior classification" was developed, and, by the introduction of a central perforated pipe, an air suction is effected practically the entire length of the grinding chamber.

In construction, the new mill consists essentially of a feeder, a revolving cylinder in which a charge of grinding balls reduces the coal to the necessary fineness, an interior classifier, an exterior separator, and an exhaust fan. The pulverized fuel is drawn through the interior classifier into the air separator, through the exhaustor, and

thence to the combustion chamber. The entire unit is compactly mounted on a rugged one-piece gray-iron bed plate, making it possible to locate the mill in a small floor space. Speed reduction is accomplished by means of a worm-and-gear reducer equipped with Timken roller bearings. All parts are inclosed in a heavy cast-iron dust-proof housing.

Feeding is accomplished uniformly by means of a slow-speed, disk-type feeder. This is driven from the mill countershaft. Variation of fuel supply necessary to meet the load demand is easily secured by hand-wheel adjustment.

The grinding cylinder is lined with rolled steel bars, securely bolted, so as to obtain the effect of "steps" inside the chamber. It can be equipped with rubber lining, if desired. The outer surface of the cylinder is covered with a thick layer of felt and the felt covered with a sheet metal jacket. The cylinder revolves on four alloy steel rollers mounted on Timken roller bearings. The proper ball charge can be maintained by adding balls through the feeder.

The function of the interior classifier, or center pipe, is to collect by suction all the finished product, when pulverized, and carry it out of the mill through the discharge conduit to the air separator. On entering this the coal is deflected over a perforated plate, through which a current of clean air is admitted. This picks up and conveys the finished product to the exhauster. The oversize returns to the feeder by gravity.

A New Four-ton Gasoline Locomotive

The George D. Whitcomb Co., of Rochelle, Ill., has recently brought out a new four-ton locomotive, known as Model "U. F.-4." The new model is built to the company's regular gasoline locomotive specifications, the general design and construction being the same as in the larger sizes. It is made in all track gages to meet the various conditions in pits, quarries, mines, road contract work, and industrial plants, and is so built that special variations of the cab for special conditions can easily be arranged. The height over the engine is 54 in., and over the cab 81 in., the wheel base being 36 in. and the length approximately 9 ft.

The new locomotive is built upon a solid, cast-iron chassis, rugged in design. The whole unit, in working order, weighs about 8,000 lb., with an average drawbar pull of 1,600 lb. Coil springs are provided on each journal box, and give an easy riding action.

The locomotive is powered with a 4-cylinder 4½ x 4½-in. Model S-4 Continental engine, fitted with a Dixie magneto and impulse starter. This engine is rated from 30 to 40 hp. at 1,200 r.p.m. and from 45 to 48 hp. at 1,800 r.p.m.

The radiator is of the special artillery type made with removable sections, which may be filled with a solid core if new sections are not available. The coupling device is arranged to allow for coupler heights of 9½, 12½, 15½, and 18½ in. which covers all standard cars.

New Automatic Welding Outfit for Construction and Repairs

Following several years of development and trial, the General Electric Co. is now marketing a line of automatic arc-welding equipments, which are sold either as complete units or as separate parts. They have been especially designed for quick, efficient, and economical welding where quantity production is a factor. Heretofore, it has been the custom to supply the separate parts only.

The new outfit is expected to find its principal application in the construction of such standard products as tanks, boilers, cans, axle housings, and pipe, and also for repairing undercut shafts or axles and building up sharp flanges on car wheels. Its field of greatest usefulness is expected to be in the manufacture of storage vessels where the static load is not greater than 10 lb. per square inch and where the thickness of the metal to be welded is not less than No. 16 gage.

Outstanding among the advantages claimed for these automatic equipments is the resulting increase in speed of production following their installation. Estimates by General Electric engineers, based on actual production, show that this increase in speed is especially marked when comparison is made between the automatic arc welder and either hand arc welding or hand gas welding. A complete outfit can be operated by a man and helper, it is said, whereas the completion of an equal amount of hand work in the same time would necessitate the use of four or more men. Estimates also indicate a lower overhead expense than with gas welding, excluding the item of labor. The use of push-button control provides simplicity and ease in operation. Uniformity of finished product and space saving by the reduction of the number of workers and the quantity of stock on hand are among other advantages claimed for this equipment.

A complete outfit consists of an automatic welding head and control panel, travel carriage, and clamping device. Where it is desired, to meet special circumstances in any plant, the travel carriage and other component parts of the equipment may be assembled by the purchaser with his own device for holding the work.

A list of products in the manufacture of which this automatic equipment is recommended includes gasoline-storage tanks, oil switch tanks, transformer tanks, range boilers, and pipe for dredging, oil-well casings, and irrigation purposes. Automatic equipments are also recommended for repairing worn car-wheel flanges, locomotive guide rods, and worn axles and shafts.

Tractor Companies Consolidate

The C. L. Best Tractor Co. has announced its consolidation with the Holt Manufacturing Co. Control of the Holt company was purchased by Pierce, Fair & Co., who control the C. L. Best Co. The latter company will maintain its plant at San Leandro, Calif., but will close the Holt plants at Stockton and will manufacture the Best caterpillar tractor at Peoria, Ill.

Trade Catalogs

Gears—A folder describing the method of making Poole machine-moulded gears has been issued by the Poole Engineering and Machine Co., Baltimore, Md.

Dump Cars—Catalog D of the Magor Car Corporation, 30 Church St., New York, is devoted to dump cars, automatic or hand-operated, standard or narrow-gage, for domestic or foreign requirements. Cars for railroad, mining, contractors' and industrial service are included.

Pumps—Cycloidal rotary pumps for lubricating oil, fuel oil, grease, chemicals, and numerous other purposes are covered in Bulletin 19D, for February, 1925, issued by the Connersville Blower Co., Connersville, Ind. Besides describing construction and design, the bulletin gives tables of sizes, capacities, speeds, and other data.

Fire Protection—"Correct Protection Against Fire" is the title of a 24-page booklet just issued by Foamite-Childs Corporation, of Utica, N. Y. The book is a popular treatise on fire protection for all sorts of risks, written in non-technical terms so that the suitability of any type of fire extinguisher for any particular risk may be determined by the layman.

Metals, Alloys—A 45-page book of descriptive matter and data regarding non-ferrous metals and alloys has been issued by Kynoch, Ltd., and King's Norton Metal Co., Ltd., of Birmingham, England, the constituent companies of Nobel Industries, Ltd. It is entitled "The Witton Book of Non-ferrous Metals and Alloys."

Belting—Flexible wire belts for industrial processes are described in the 8-page catalog issued by the Industrial Conveyor Co., 1085 Broad St., Newark, N. J.

Lifting Magnets—Bulletin 107 of the Ohio Electric & Controller Co., Cleveland, Ohio, covers Ohio lifting magnets for iron and steel trades and for the removal of tramp iron from feeder belts, and for other purposes. Twenty-four pages, illustrated.

Cement—A 32-page book describing Lumnite cement has been issued by the Atlas Lumnite Cement Co., 25 Broadway, New York. The company claims that this cement will make full strength concrete in twenty-four hours.

Pipe Flanges—The American Spiral Pipe Works, Chicago, Ill., has issued Catalog No. 24, of 86 pages indexed, covering forged-steel pipe flanges. It is intended to serve as a handbook of information for engineers, designers, and operators of power systems. Formulas and data tables are useful features of the pamphlet; also the new American Engineering Standards of 400, 600, and 900 lb. W. S. P. A section on corrugated-steel furnaces is included.

Wire Cloth—Catalog 25 of the Newark Wire Cloth Co., Newark, N. J., covers wire cloth and wire-cloth products. It contains 62 pages, illustrated.

Woodworking Machinery—P. B. Yates Machine Co., Beloit, Wis., has issued Catalog No. 14, of 223 pages, covering its complete line of woodworking machinery.

The Market Report

Daily Prices of Metals

Apr.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
2	13.35	51.00	51.75	8.25@8.50	8.00	7.05
3	13.30	50.75	51.50	8.25@8.50	8.00	7.05
4	13.25	50.50	51.25	8.25@8.50	8.00	7.05
6	13.25	49.75	50.50	8.05@8.25	7.90	7.05@7.10
7	13.25	50.625	51.375	8.05@8.25	7.80	7.10
8	13.30@13.375	50.375	51.125	8.05@8.25	7.80	7.125@7.15
Av.	13.290	50.500	51.250	8.263	7.917	7.077

*The prices correspond to the following quotations for copper delivered: April 2d, 13.60c.; 3d, 13.55c.; 4th to 7th, 13.50c.; 8th, 13.55@13.625c.

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

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

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

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

London

Apr.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
2	60 $\frac{1}{4}$	61 $\frac{3}{8}$	64 $\frac{3}{4}$	237 $\frac{1}{4}$	241 $\frac{1}{4}$	34 $\frac{1}{2}$	33	34 $\frac{3}{16}$	33 $\frac{1}{2}$
3	60 $\frac{1}{4}$	61 $\frac{3}{8}$	64 $\frac{3}{4}$	233 $\frac{3}{4}$	237 $\frac{1}{2}$	34 $\frac{3}{8}$	33	34 $\frac{9}{16}$	33 $\frac{9}{16}$
6	60 $\frac{1}{4}$	61 $\frac{1}{2}$	64	231 $\frac{1}{4}$	234 $\frac{3}{4}$	33 $\frac{5}{16}$	32 $\frac{1}{2}$	34 $\frac{3}{8}$	33 $\frac{3}{8}$
7	60 $\frac{1}{4}$	61 $\frac{1}{2}$	64	232	235 $\frac{1}{4}$	32 $\frac{7}{8}$	31 $\frac{3}{4}$	34 $\frac{9}{16}$	33 $\frac{9}{16}$
8	60 $\frac{3}{4}$	61 $\frac{1}{4}$	64 $\frac{3}{4}$	233 $\frac{1}{4}$	236 $\frac{1}{2}$	32 $\frac{7}{8}$	32 $\frac{1}{2}$	35 $\frac{1}{8}$	33 $\frac{7}{8}$

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

Silver, Gold, and Sterling Exchange

Apr.	Sterling Exchange "Checks"	Silver			Apr.	Sterling Exchange "Checks"	Silver		
		New York	London	Gold London			New York	London	Gold London
2	4.77 $\frac{1}{8}$	66 $\frac{1}{2}$	31 $\frac{7}{16}$	86s 6d	6	4.78 $\frac{3}{8}$	67 $\frac{1}{8}$	31 $\frac{9}{16}$	86s 5d
3	4.77 $\frac{3}{8}$	66 $\frac{3}{8}$	31 $\frac{7}{16}$	86s 6d	7	4.78 $\frac{1}{2}$	66 $\frac{3}{8}$	31 $\frac{1}{2}$	86s 5d
4	4.77 $\frac{3}{8}$	66 $\frac{3}{8}$	31 $\frac{7}{16}$	8	4.78 $\frac{3}{8}$	66 $\frac{3}{8}$	31 $\frac{1}{2}$	86s 5d

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

Sentiment Better, Though Metals Remain Quiet

New York, April 8, 1925.—The week ending today has not been so satisfactory as last week so far as the volume of sales goes and the prices which were received. Copper has been substantially unchanged, but lead, zinc, and tin all reached new lows for the current movement. In the last day or two, however, sentiment has improved and prices, except for lead, tended to advance, though consumers continue to show little interest in the market, apparently waiting to see if the strength is going to be maintained. When they feel that the bottom has been reached and that the price tendency is likely to be upward for a few weeks, a comparatively large volume of business should be done in all

the metals, for consumption is good, and buying has been largely on a hand-to-mouth scale since the first of the year. The better sentiment of the last day or two has no doubt been caused by the increasing strength of the stock market and by better buying and increasing prices in foreign metal markets; it is generally felt that the reaction in all markets has been somewhat overdone.

Copper in Less Demand

Practically all producers report less business than last week, with only occasional small sales, largely for April or May shipment, in the domestic market. The 13 $\frac{3}{4}$ c. delivered price which

obtained last Wednesday continued into Thursday and Friday, though some sales were made $\frac{1}{2}$ c. above and below this figure. On Saturday, Monday and Tuesday, 13 $\frac{1}{2}$ c. was all that could be obtained by most sellers for Eastern deliveries, and sales were not active even at that level. Today, practically every one is quoting 13 $\frac{3}{4}$ c. again, but the advance seems to have stimulated no business. Producers feel that with the advance in London and the favorable statistics, they are justified in asking higher prices. The statistics show a decrease in the stocks of 14,000 tons from three months ago, the stock of refined copper on March 31 being 122,000 tons. Refinery production, including copper from scrap, was 328,000 tons in the first quarter, compared with 334,000 tons in the last quarter of 1924, this being a very slight increase per day, as the period was two days shorter. Export shipments decreased from 159,000 to 150,000 tons in the first quarter, but domestic shipments made a startling increase from 175,000 tons in the last quarter of 1924 to 192,000 tons. This reflects the excellent business done by manufacturers so far this year; the brass business has been particularly good, and in some instances the wartime peak of production has been exceeded.

Foreign demand the last week has improved, particularly in the last few days, when dealers have been scouring the market here to pick up what copper they could for export. Today's price is about 13.50c., f.a.s.

Lead Market Shows Further Weakness

The contract price of the American Smelting & Refining Co. was reduced on April 7 to 825c. per lb., New York, which was a cut of one-quarter cent.

In the open market for lead, sales were light for most producers with one exception, this producer booking a substantial tonnage nearly every day. Lead was sold during the week at market concessions below the contract price. On April 2 the metal was purchased for 8.25c. per lb., New York; on Tuesday, a fair-sized lot changed hands at 8.125c., and this was of a corroding grade. Consumers seem to require immediate shipment for all orders. There has been practically no demand for May lead. This situation also applied to the St. Louis market, where sales were made in the last two days as low as 7.80c. Earlier in the week the metal was bought for 8c. per lb. The downward movement of the London price has been the principal contributing cause to the decline in these markets, and inasmuch as the price abroad has displayed a firmer tendency today, producers have become heartened. Consumers report a falling off of demand for lead products in some lines and a recovery in others, notably blue lead products. Producers in some cases

have no stocks of lead on hand; in others only a small amount is available for sale. The statistical position of lead remains strong, with the main uneasiness in the market centered in Europe.

Brass Makers Buy Zinc

Zinc has sold in only modest tonnages, despite the drop in the price to close to 7c. Only a little was sold to galvanizers, but brass interests showed a little more interest, and a fair tonnage of Brass Special found a home at a premium of about 10c. per 100 lb. over the price of Prime Western. In the last day or two the market has worked back up to 7.15c., with more interest being shown by foreign buyers. Prices abroad have prevented much export business lately. High-grade zinc has been very quiet at unchanged prices of 8½@8¾c. per lb. delivered.

Tin Under Speculative Influences

Speculation and manipulation was even more evident in the tin market during the last week than in previous ones. Prices have been erratic, but have generally moved downward, without, however, attracting the amount of buying that might be expected. The low for the week was reached on Monday, when tin was sold for 50½c. per lb. Forward metal has been slightly higher.

Silver Records New Low for 1925

During the last week new low quotations for silver for the year 1925 were established in both the London and New York markets. China is not an interested buyer, and orders from the Indian bazaars are for limited amounts only and at lower than current rates. The narrowness and quiet of the market have been accentuated by the approaching Easter holidays.

Mexican Dollars—April 2d and 3d, 51½c.; 4th, 51½c.; 6th, 51½c.; 7th and 8th, 51½c.

Foreign Exchanges Dull

The foreign exchange market has been dull; sterling has held steady, but francs were noticeably weaker. Closing cable quotations on Tuesday, April 7, were as follows: Francs, 5.1425c.; lire, 4.095c.; and marks, 23.81c. Canadian dollars, 1/8 per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

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

Antimony

Chinese brands, 13.75@14c. per lb.
Cookson's "C" grade, 16¾@17¼c.
Chinese needle, lump, nominal, 10c.
Standard powdered needle, 200 mesh, 11½@13c.

White oxide, Chinese, 99 per cent Sb.O₃, 16@16½c.

Bismuth—\$1.95 per lb., in ton lots. London, 7s. 6d.

Cadmium—60c. per lb. London, 2s. 2d.@2s. 6d.

Iridium—\$375@\$400 per oz. London £70.

Nickel—Ingot, 31c.; shot, 32c.; electrolytic, 38c.; London, £170 per long ton.

Palladium—\$79@\$83 per oz. London £17.

Platinum—April 2d, 3d and 4th, \$117; 6th, 7th and 8th, \$118.50 per oz. for refined. London, £25 per oz. Crude, \$115.

Quicksilver — \$82 per 75-lb. flask. San Francisco wires \$80.65. Quiet. London £14.

The prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmiridium, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the prices given in the April 4 issue.

Metallic Ores

Chrome Ore—\$22.50@\$23 per ton, c.i.f. Atlantic ports.

Iron Ore—Contract prices for the 1925 season have been established at levels 50c. per long ton below those of 1924, on non-bessemer ores, which, in turn, were 80c. below 1923. Lake Superior ores, per long ton, Lower Lake ports:

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

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

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

Tungsten Ore—Per unit, N. Y.: Chinese wolframite, \$11.

High-grade Western scheelite, \$11@ \$11.50 nominal.

Galena Radio Crystals, Manganese, Molybdenum, Tantalum, and Vanadium Ores are unchanged from April 4 quotations.

Zinc Blende and Lead Ore Again Lowered

Joplin, Mo., April 4, 1925

Zinc Blende	Per Ton
High	\$55.60
Premium, basis 60 per cent zinc	\$52.00@\$53.00
Prime Western, 60 per cent zinc	\$50.00
Fines and slimes	\$49.00@\$47.00
Average settling price, all ores	\$53.00
Lead Ore	
High	\$128.65
Basis 80 per cent lead	\$100.00
Average settling price, all ore	\$117.66

Shipments for the week: Blende, 15,660; lead, 2,410 tons. Value, all ores the week, \$1,113,520.

Sellers began by asking prices current last week, but buyers would not offer more than \$50 basis Prime Western and \$53 for Premium, which level some sellers finally accepted late today. The sale is about two-thirds of the week's production. It is reported that nearly all producers will withdraw night shifts tonight, and a number have said that they will close down mills for general repairing and overhauling. It is hoped to reduce the output to about 2,000 tons per week until demand shall indicate the necessity of a larger production.

In closing on a \$100 basis lead has declined \$46 per ton since the high level the third week of January.

Purchases of zinc ore the last two weeks totaled 22,540 tons, against an output of 32,000 tons.

Platteville, Wis., April 4, 1925

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	\$50.00
Lead Ore	
Lead, basis 80 per cent lead	\$100.00

Shipments for the week: Blende, 636 tons; lead, 55 tons. Shipments for the year: Blende, 9,396; lead, 567 tons. Shipments for the week to separating plants, 1,716 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Beryl, Borax, Celestite, Chalk, China Clay, Corundum, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Ozocerite, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from April 4 prices.

Mineral Products

Arsenious Oxide (white arsenic)—5½@5¾c. per lb. Meager business.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and Zinc Oxide are unchanged from April 4 prices.

Ferro-Alloys

Ferromanganese—Domestic, German, and English, \$115 per gross ton, f.o.b. works, or duty paid at seaport.

Ferrosilicon—10 to 12 per cent, \$34@\$40 per gross ton, f.o.b. works.

Ferrocium, Ferrochrome, Ferromolybdenum, Ferrotitanium, Ferrotungsten, Ferrouanium and Ferrovandium are unchanged from the prices given in the April 4 issue.

Metal Products

Rolled Copper, Lead Sheets, Nickel Silver, Yellow Metal and Zinc Sheets are unchanged from the issue of April 4.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick, and Zirkite are unchanged from April 4 prices.

Steel Prices Inactive—Pig Iron Slow

Pittsburgh, April 7, 1925

Steel consumption in general is increasing rather than decreasing.

Finished-steel prices have undergone no quotable change for more than a fortnight. Recent nominal asking prices on billets and sheet bars must now be disregarded, as first-quarter contracts at \$35.50 to \$36 for billets and \$37 for sheet bars were not specified in full, yet the unspecified tonnages were not canceled by producers, showing that values are not above the figures mentioned.

Pig Iron—The market has continued stagnant. Basic is offered at \$20.50, a decline of 50c., bessemer remaining at \$22 and foundry at \$21, all prices being at Valley furnaces.

Connellsville Coke—Market dull and spot prices not firm at \$3.25 for furnace and \$4@\$4.50 for foundry.

Company Reports

Howe Sound Co.

Copper; British Columbia

With the Britannia mine, in British Columbia, in better condition for maximum production of copper ores than heretofore; the improvement in operating and metallurgical practice in the concentration thereof; the addition of a mill for the treatment of the lead-zinc sulphides produced by El Potosi which will increase the net returns therefrom, and the initiation of shipments of similar ores from the Calera mine, the outlook for sustained and improving net returns to Howe Sound under normal metal-market conditions is better than at any other time in the history of the company.

The year 1924, the first since 1919 in which there has been a continuous twelve months' operation, shows a production of 26,398,539 lb. of copper, 4,684 oz. of gold, and 125,687 oz. of silver—Britannia's record yield.

The ore reserves of the Britannia mine total 5,719,211 tons, averaging 2.1 per cent copper; of this tonnage 1,529,208 tons are broken in stopes.

At El Potosi the production for the year was 1,791,689 oz. of silver and 24,973,462 lb. of lead. There was no production from the Calera mine.

The company made a profit after depletion and depreciation of \$415,080 and paid one dividend totaling \$99,207.50.

Balance Sheet, Dec. 31, 1924

Assets			
Mining property.....	\$8,146,820.28		
Plant, buildings and machinery.....	7,656,181.88		
Investments.....	907,473.30	\$16,710,475.46	
Deferred charges.....		155,393.84	
Reserve funds.....		195,302.02	
Current.....		3,021,310.44	
		\$20,082,481.76	
Liabilities			
Capital stock.....	\$1,984,150.00		
Twenty-year 6 per cent gold bonds.....	2,959,000.00		
Reserves.....	9,295,488.04		
Profit and loss.....	4,807,464.09		
Balance as at Dec. 31, 1923.....	\$4,744,311.46		
Profit.....	415,079.83		
Less.....	\$5,159,391.29		
Dividend No. 16 at 5c. per share.....	\$99,207.50		
Proportion amortization deferred charges accrued.....	252,719.70	351,927.20	
Current liabilities.....		1,036,379.63	
		\$20,082,481.76	

Profit-and-Loss Account

Mining.....	\$2,001,374.60
Transportation.....	227,549.27
Milling.....	499,527.36
Smelting and marketing.....	1,872,250.52
Administration.....	121,024.57
Taxes.....	148,635.02
Balance.....	1,430,811.15
	\$6,301,172.49
Depreciation and depletion.....	827,237.12
Interest.....	188,494.20
Balance.....	415,079.83
	\$1,430,811.15
Smelter returns.....	\$6,132,697.29
Miscellaneous income.....	168,475.20
	\$6,301,172.49
Balance brought down.....	\$1,430,811.15

Calumet & Hecla Consolidated Copper Co.

During 1924 there was produced from the mines of the Calumet & Hecla Consolidated Copper Co. 54,510,000 lb. of copper at an average cost sold, but not including depreciation or depletion, of 12.48c. per pound. During the same period there was produced by the reclamation plant at Lake Linden 18,627,000 lb. of copper at an average cost sold of 7.83c. per pound. The average price received for copper delivered during the year was 13.05c. per pound.

Operations were conducted at No. 1 shaft North Kearsarge and at Nos. 2, 3 and 4 shafts Ahmeek.

Aside from pumping, no work was done in Allouez or Centennial.

The smelter received a total of 70,763 tons of concentrates

and mass for the year, of which 63,350 tons was from the mills of this company, 6,040 tons from the Isle Royale, and 1,373 tons from the Seneca Copper Corporation. In the same period 74,544 tons was smelted, of which 66,647 tons was this company's.

The financial results show a loss of \$1,634,439.61 for the year after all charges.

Earnings Statement

Receipts			
Copper sales.....	\$9,229,251.41		
Custom milling and smelting.....	100,498.38		
Dividends.....	19,106.29		
Interest.....	192,697.64		
Miscellaneous.....	39,187.19	\$9,580,740.91	
Disbursements			
Copper on hand Jan. 1, 1924.....	\$4,816,494.63		
Production, selling, administration and taxes.....	8,251,970.37		
Depreciation and depletion.....	3,693,191.73		
Miscellaneous.....	320,432.54		
	\$17,082,089.27		
Less copper on hand Dec. 31, 1924.....	5,866,908.75	11,215,180.52	
Loss for year.....		\$1,634,439.61	

Balance Sheet, Dec. 31, 1924

Assets			
Current assets.....		\$14,487,339.72	
Investments in other companies (book value).....		1,901,796.57	
Capital assets (book value).....	\$82,219,592.32		
Less reserves for depreciation and depletion.....	16,633,676.49	65,585,915.83	
Stamp mill patents.....		35,480.97	70,350,790.73
Total assets.....			\$86,739,927.02
Liabilities			
Current liabilities.....		\$1,167,798.18	
Capital stock.....		50,137,550.00	
Issued, 2,005,502 shares par value \$25 per share full paid			
Surplus.....			
Paid-in surplus Jan. 1, 1924.....	\$38,071,769.45		
Loss by 1924 operations.....	\$1,634,439.61		
Dividend paid.....	1,002,751.00	2,637,190.61	35,434,578.84
Total liabilities, capital and surplus.....			\$86,739,927.02

New Cornelia Copper Co.

Copper; Ajo, Ariz.

A report of the New Cornelia Copper Co. for 1924 states that a net income of \$581,087.60 was earned after deductions for depletion and depreciation.

Balance Sheet, Dec. 31, 1924

Assets			
Mining property.....	\$28,075,880.55		
Less depletion.....	6,639,428.21		
		\$21,436,452.34	
Construction.....		6,864,601.30	
Investments (at cost).....		255,700.00	
Accounts receivable.....		1,386,691.96	
Ca-h.....		81,505.72	
Supplies.....		522,895.07	
Metals on hand.....		2,296,118.70	
Deferred charges to operations.....		275,720.71	
Items in suspense.....		24,963.30	
		\$33,144,649.10	
Liabilities			
Capital stock.....		\$9,000,000.00	
Notes and accounts payable.....		3,169,048.98	
Reserve items.....		98,837.38	
Surplus.....		20,876,762.74	
Earned surplus Dec. 31, 1923.....	\$99,940.96 (a)		
Income 1924.....	581,087.60		
		\$481,146.64	
Less dividends.....		675,000.00	
Earned surplus Dec. 31, 1924.....	\$193,853.36 (a)		
Paid in surplus.....	\$21,745,616.10		
Less capital distribution.....	675,000.00		
Paid in Dec. 31, 1924.....	21,070,616.10		
		\$33,144,649.10	

(a) Deficit.

The production of fine copper, silver, and gold for the year was as follows:

Fine copper, lb.....	63,884,293
Silver, oz.....	162,067.60
Gold, oz.....	10,675.48

Sales of copper during the year amounted to 56,302,200 lb., which was sold at an average of 13.1791c. a pound.

Distributions made to stockholders in 1924 totaled \$1,350,000.00.

Bunker Hill & Sullivan Mining & Concentrating Co.

Silver, Lead; Kellogg, Idaho

A report detailing the operations of the Bunker Hill & Sullivan Mining & Concentrating Co. for 1924, states that the mine yielded approximately the same tonnage as during the previous year; the grade, however, was slightly better, resulting in a substantially higher yield of lead and silver for 1924. This, with the better prices received for lead, returned an operating profit of more than \$500,000 over that of the preceding year.

Ore blocked out to date as follows:

	Tons
Stemwinder mine.....	5,472
Sullivan mine.....	71,823
Bunker Hill mine.....	4,082,611
Total.....	4,159,906

Balance Sheet Dec. 31, 1924

Assets	
Capital assets.....	\$43,019,223.08
Current and inventoried assets.....	4,354,428.99
Other assets.....	210,686.71
Liabilities	\$47,584,338.78
Current liabilities.....	\$1,454,182.04
Capital stock.....	3,270,000.00
Surplus	
Normal surplus.....	\$8,855,587.84
Property revaluations surplus.....	34,004,568.90
Total.....	\$47,584,338.78

Revenue

Production revenue.....	\$6,756,342.84
Production and marketing costs.....	4,005,337.14
Operating profit before depletion.....	\$2,751,005.70
Other net revenue after income taxes.....	174,552.96
Operating surplus before depletion.....	\$2,925,558.66
Deduct depletion.....	574,872.57
Operating surplus after depletion.....	\$2,350,686.09

Analysis of Surplus

Normal surplus balance Dec. 31, 1923.....	\$8,000,455.90
Operating surplus for 1924, before depletion..	\$2,925,558.66
Less proportion of 1924 depletion.....	108,426.72
Total.....	\$10,817,587.84
Deduct dividends paid in 1924.....	1,962,000.00
Balance Dec. 31, 1924.....	\$8,855,587.84
Revaluation surplus	
Balance Dec. 31, 1923, per annual report.....	\$34,471,014.75
Less proportion of 1924 depletion.....	466,445.85
Balance Dec. 31, 1924.....	\$34,004,568.90
Total.....	\$42,860,156.74

Production amounted to 422,907 tons, yielding 5,697.9 tons of concentrates assaying 56.3 per cent lead and 19.4 oz. of silver per ton.

Old Dominion Co.

Copper, Gold, Silver; Globe, Ariz.

A report of the Old Dominion Co. for 1924 states that the total production for the year including customs ores was 25,400,670 lb. of refined copper, 155,814 oz. of silver, and 5,531 oz. of gold. A total of 28,151,261 lb. of refined copper was sold to buyers at an average price of 13.288c. per pound.

Net income before depletion amounted to \$119,823.03.

Balance Sheet, Dec. 31, 1924

Assets	
Fixed.....	\$17,328,533.17
Current.....	1,705,061.16
Liabilities	\$19,033,594.33
Capital stock	
Authorized and issued—350,000 shares of \$25.....	\$8,750,000.00
Current.....	824,911.02
Depreciation.....	\$4,921,382.59
Depreciation.....	3,972,825.23
Surplus	8,895,207.82
Balance Dec. 31, 1923.....	\$871,331.16
Income for 1924.....	119,823.03
Total.....	\$991,154.19
Deduct depletion for 1924.....	427,678.70
Total.....	\$563,475.49
Total.....	\$19,033,594.33

Calumet & Arizona Mining Co.

A report of the Calumet & Arizona Mining Co. for 1924 shows a net income of \$428,629.89 after depreciation and depletion.

Balance Sheet, Dec. 31, 1924

Assets	
Mining property.....	\$29,644,491.00
Less depletion.....	11,401,739.24
Construction at mines.....	\$18,242,751.76
Smelting plant.....	476,209.90
Sulphuric acid plant.....	1,910,780.34
Construction at 85 Branch.....	458,423.70
Investments (at cost).....	225,234.73
Notes and accounts receivable.....	7,513,382.59
Supplies at mines and smelter.....	3,449,337.26
Cash.....	641,886.57
Metals on hand and in process.....	1,234,944.55
Items in suspense.....	989,442.84
Deferred charges to operations.....	81,463.83
Liabilities	\$36,251,747.62
Outstanding capital stock.....	\$6,425,320.00
Accounts payable.....	810,724.48
Reserve items.....	398,839.85
Surplus.....	28,616,863.29
Earned surplus Dec. 31, 1923.....	\$1,421,456.34
Income, year 1924.....	428,629.89
Total.....	\$1,850,086.23
Less dividends paid in 1924.....	1,285,063.00
Earned surplus Dec. 31, 1924.....	\$565,023.23
Paid in surplus, Dec. 31, 1924.....	28,051,840.06
Total.....	\$36,251,747.62

The production of fine copper, silver and gold was as follows:

	Copper, Lb.	Silver, Oz.	Gold, Oz.
From domestic ores treated.....	40,039,380	757,375.41	30,081.648
In domestic ores sold.....	1,542,650	56,414.65	1,852.542
Total.....	41,582,030	813,791.06	31,934.190
From foreign ores.....	357,071	113,897.80	1,925.770
Total.....	41,939.101	927,688.86	33,859.960

Sales of copper during the year amounted to 46,703,372 lb., for which an average price of 13.2697c. per pound was received.

Dividends paid during the year from surplus totaled \$1,285,063.00

Iron Cap Copper Co.

Copper; Copperhill, Ariz.

A report of operations of the Iron Cap Copper Co. for 1924 with comparison with 1923 gives the following production record:

	1923	1924
Dry tons ore.....	83,931	83,312
Ounces of silver recovered.....	75,982	85,680
Pounds of copper recovered.....	6,134,162	5,383,0596
Average prices obtained:		
Silver per ounce.....	\$0.77826	\$0.6725
Copper per pound.....	.14446	.13024

Income account shows a loss of \$219,558.75 after depletion and depreciation:

Balance Sheet, Dec. 31, 1924

Assets	
Mining property.....	\$2,327,495.66
Current assets.....	474,052.47
Deferred charges.....	21,781.96
Deficit.....	386,887.76
Liabilities	\$3,210,217.85
Capital stock.....	\$1,421,040.00
First-mortgage 8 per cent bonds.....	381,220.00
Accounts payable.....	22,262.57
Reserve for taxes and bond interest.....	18,139.53
Reserve for depletion.....	1,331,693.29
Reserve for contingencies.....	35,862.46
Total.....	\$3,210,217.85

Callahan Zinc-Lead Co.

Lead, Zinc; Idaho

According to its report for 1924 the Callahan Zinc-Lead Co. was unproductive during the year. The Galena property is being developed. A deficit of \$191,334.78 was incurred during the year. Balance sheet of Dec. 31, 1924, shows current assets of \$847,712, compared with current liabilities of \$835,300. Cash on hand amounted to \$279,344.

Mining Stocks

Week Ended April 4, 1925

Table with columns: Stock, Exch., High, Low, Last, Last Div. Categories include COPPER, NICKEL-COPPER, LEAD, ZINC, SILVER, GOLD, and GOLD AND SILVER. Lists various mining companies like Alaska-Br. Col., Anaconda, Arcadian Consol., etc., with their respective stock prices and dividends.

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend. Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moyses & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange and George H. Watson & Co.; Colorado Springs, Colorado Springs Stock Exchange.