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ENGINEERING AND MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

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The Consumer's View of the Anthracite Strike In Pennsylvania

THE LATEST STRIKE of the anthracite coal miners leaves the public bored. This particular stunt has been presented too often to arouse great interest. In a land teeming with coal situated at the doors of the great centers of industry and population, the American people have become used to having their coal supply shut off as winter comes on, or the brutal threat made of having it shut off, and of forcing them to suffer from the cold. This is the precise weapon and plan of the leaders of the strikers; and they expect that, as in the past, the good and simple people of the United States, inspecting their empty coal bins and the increasing chill in the fall days, will frantically shriek to their governor, to their president, to "do something," so that they may get their anthracite for the winter and get it at once.

But the American people, ever seeking something new, is apparently weary of that particular brand of excitement. The householders having learned to have no confidence in the behavior of the anthracite people, have largely bought their coal and put it in the bins last spring; and now pay scant attention to the hue and cry. They have other things to think of. Besides that, they have learned to use bituminous coal and coke, and even wood: some have put in petroleum or gas heaters; others have gone or are considering going to Florida. Altogether, they believe they will pass the winter safely; besides, they are somewhat displeased, secretly, with being trifled with so barefacedly. Even the newspapers pay slight attention to the crisis, though State Commissions, which have functioned on former occasions, have been quickly reorganized.

The public, in its reaction, does not enter into the merits or demerits of the problem: it only knows that it is receiving poor service and is being deliberately "worked" by these repeated hold-ups of coal. Its disapproval is generous and catholic—including, in a vague way, operator and miner—with a fair share for the retailer. No matter what the situation may be, it is too much for the coal mine operators to expect that the public will regard them with anything but suspicion; and no matter what the labor union chiefs may try to propagate, it is useless for them to expect sympathy for coal miners who habitually strike and shut off the fuel supply.

Our information as to the real merits of the anthracite strike is that there is no cause for striking; that there is no dissatisfaction among the anthracite miners; that they are earning around \$8 or \$9 a day, and that even the boys do not earn less than \$5; that no mine can get labor without providing great parking space for automobiles and in many places separate heated garages. Compare the situation with the metal miners, who get say \$3.50 to \$5.50 a day throughout the West. Under normal conditions, before the war, metal miners

earned more than coal miners, which was right, since metal mining is more complex and demands a higher type of workman. Either, then, the anthracite worker is actually getting too much; or the metal mine worker too little. Probably both are true. At any rate, even a coal miner should blush through his coal-dust to strike for higher pay. As a matter of fact the general agreement is that the strike is no quarrel of the anthracite miners against their employers or the public. They are "called out" by their senior chiefs as pawns in another game, and one in which they have no particular interest. The real battlefield of strategy is the bituminous coal regions. While the anthracite industry is all unionized, the bituminous fields are divided into union and non-union areas. An agreement was signed nearly two years ago between union labor chiefs and representatives of employing companies (the Jacksonville agreement) whereby a certain union wage scale should be paid until 1927. The result has been to place the mines which worked under this agreement at a disadvantage, for with the scale of wages they paid they could not well compete with the non-union fields; so that the proportion of non-union coal mined has increased from about 30 per cent to about 70 per cent. Many union mines closed down. Some of them were opened at the request of the idle miners, at a lower wage scale, thereby breaking the Jacksonville agreement. Other mine operators, faced with failure or shut-downs, have devised other means to evade and break their agreements. Unquestionably they have been forced into the position of having failed to carry out a contract, and the labor leaders have been astute enough to take full strategic advantage of this predicament, although it bears as heavily on the union miners as on their employers. Yet it is too good a trap to let the operators out of, and so the union leaders will not consent to modify the Jacksonville agreement and wage scale. And to direct national attention to the iniquity of the operators, the union leaders call out on strike the opulent hard coal miners, that the public may freeze and pay attention to the aforesaid iniquity of the aforesaid bituminous operators.

Manifestly the situation is not simple; but the interests of the unoffending third party, the American people, are certainly being unfairly attacked and trifled with by the war-time tactics of the union leaders. And if the public can manage to refrain from an undignified surrender under a cold-blooded and calculated pressure, it will do wisely. Let the public, and by all means the government, the public's representatives, keep hands off and let the muddlers muddle their way out of it. In no event should it offer any encouragement to an enemy which attempts to force it, by the threat of suffering from cold and stoppage of industries, to agree blindly to a strategy which has an objective the value of which has to be proved and which many suspect to be largely a forwarding of personal ambitions.

"Shorting" a Mining Stock

RECENTLY a subscriber propounded this query: "If shares in a mining company are being traded in on the New York Curb Market at \$100 per share or thereabouts, when their intrinsic worth, based on the speculative value of the property controlled, is estimated by reputable engineers to be not more than \$10, why is it not possible for an individual to sell the stock 'short' and realize a big profit on the decline." A similar question has been asked by others. Such a maneuver is not impossible, but it is often difficult and always risky, if attempted on any considerable scale, for the following reasons:

To execute a short sale it is necessary for the broker of the seller to borrow stock certificates covering the shares involved, in order to make the delivery. This he does usually from the broker who is "sponsor" for or who specializes in the stock. However, he must be prepared at any time to replace the certificates on demand. If the market goes down he can buy shares cheaply to fulfill his obligation to the lender; and the winnings, minus commissions and interest, accrue to the account of the short seller. If on the other hand the market goes up, the broker, in behalf of his client, must be prepared to pay the higher prices to replace the borrowed shares. The New York Stock Exchange has machinery for the large-scale loaning of shares to short sellers; its listing requirements are aimed to insure a wide public distribution of shares so that there may be free trading in a genuine open market. Even here, however, it occasionally happens that large short interests find themselves unable to cover their sales at any price, as the insiders are ready and able to absorb all the shares that are offered. This situation is called a "squeeze" and the unfortunate shorts usually extricate themselves by "seeing the captain." An arbitrary price is named at which settlement is made; this arrangement usually is accomplished privately, so as to avoid a public scandal. Gossip in Wall Street is that only recently a large operator in a well-known motor stock was caught in this manner and paid several million dollars to settle. Nevertheless short selling is done constantly on the Big Exchange, and such operations in most of the reputable and established stocks can be conducted through any broker.

With most of the stocks traded on the New York Curb the situation is different. In the first place the listing requirements of the Curb are not strict; and it is well known that they frequently are ignored or evaded. The requirement that 15 per cent of the total issued shares must be in the hands of the public can be evaded by the expedient of assigning a block of shares to a stenographer long enough to prepare a statement regarding outside holdings.

When the promoters of a newly listed issue own or control virtually all of the shares, manipulation of the market is easy. They keep the floating supply at a minimum, and through their brokers, they know where most of it is at all times. When a market has been "rigged" and a stock boosted by artificial means to fantastic figures, no outside broker is anxious to take short business. Even if he be willing to try, it is by no means certain that he can borrow shares for the reason that there is no effective machinery for the loaning of shares in connection with the Curb. The fact that such shares are not accepted as collateral by banks tends further to curtail the available supply.

The purpose of a borrower is obvious, and promoters and their brokers on the inside are not likely to be willing to loan shares to enable some one else to "short" a market that they have made. When the time comes they will do the shorting themselves and thereby reap what remains of the harvest.

If the broker for the outsider found that he could borrow shares in reasonably large quantity he would at once suspect that the insiders had the market so well in hand that they felt sure they could boost it much higher and squeeze the outsider who had an ambition to go short. Even assuming that the stock can be borrowed, the average broker advises his client, quite rightly, against short operations in a market of this kind. The possible gain is not enough to warrant taking the risk involved. In fact the competent broker can usually sense a stock that is floated principally for market operations; if he is honest as well as wise he advises his client against playing with it—there are too many legitimate speculations, mining included, in which to put money.

Canada Goes to the Polls

CANADA IS TO HAVE a general election on Oct. 29, the first since 1921. The politics of that country are a closed book to most of our readers, who are more interested in her natural and man-made attractions as a tourist resort. In fact, most citizens of the United States think that everything is calm and peaceful within the boundaries of our northern neighbor and that the messed-up politics of North America are confined to the United States and Mexico. Not so: the Liberals, who correspond in a way to our Democrats and who have been in power for four years, are being attacked on both flanks by the Conservatives and Progressives, and their chances of success have waned. Taking a middle course on the tariff they have displeased the Conservatives of the Eastern half of the country who are high protectionists, no less than the Progressives of the West. Many other subjects are also in dispute between the various geographical, racial, and religious groups so that the situation is strangely complex. The outcome will be of great interest to every student of North American politics.

Hydro-electric Power Instead of Anthracite

IT IS NOT DUE to a lack of coal in Nature's storehouse that this country is faced with uncertainty as to its supply of power and heat. The uncertainty of the supply of fuel has been demonstrated frequently during the last twenty years, and is today an actual condition in that portion of the United States dependent upon anthracite. That which is taking place in north-east Pennsylvania today may easily be extended to the bituminous fields, resulting disastrously to all industries. A dependable supply of available energy, whether it be in the form of coal, water-power, sun's rays, or radioactivity, is what the public demands.

Labor, political, and industrial conditions will have to be changed materially before a dependable supply of coal can be assured. Human nature has changed but little through ages of evolution. The life of an individual, or even the life of a nation, is too brief to note any marked change. The human element is a large factor in the present-day fuel question. The miner

wants more pay and more leisure; the operator wants to maintain a safe return on his investment and desires more business. There is a limit to which wages and leisure can be maintained and at the same time permit an industry to yield a fair rate of interest on its investments. It resolves itself into an equation in economics in which sales minus costs equal profits.

Costs include not only the actual wages paid in the mining and marketing of anthracite but include wages paid in other industries that supply materials to the industry in question. When costs equal sales, profits will be zero, and capital will seek other investments. In fact, capital will withdraw from an industry before the zero limit of profits is reached.

An indication of the economic result of such uncertainty is the trend toward substitutes for anthracite. New England, for example, is developing the use of coke, soft coal, and oil. Yet the stigma of uncertainty attaches also to all of these, even if to a less degree than anthracite; so that New England is proceeding further and planning the extensive utilization of water-power.

On Sept. 14, the people of Maine voted "yes" by an overwhelming majority, 40,000 to 5,000, on the proposition to develop electrical power from the tides of Fundy. The plan will cost the people of Maine nothing, but Maine is protected in that all demands for power from within her borders must be satisfied before exporting electrical energy.

Not superpower, but a superabundance of power as the tides of Fundy and Quoddy ebb and flow with a rise and fall of 20 to 70 ft., is the verdict of the voters of Maine. The State of Maine, with a rock-bound coast on the south, an inhospitable winter climate, meager agricultural possibilities, limited mineral resources, *no coal* and *no oil*, has come to the realization that she has untold wealth in power. "Power to burn" in lieu of coal.

The plan proposed contemplates the production of a minimum of 500,000 hp., or five times the minimum proposed at Muscle Shoals. The dependable power amounts to 3,268,000,000 kw.-hr. per year. Maine, at present, uses 500,000,000 kw.-hr., or only one-sixth of the amount that the contemplated plant will produce. The electric power produced by the Public Utility plants in Maine, New Hampshire, Massachusetts, and Connecticut in 1923 was 3,303,000,000 kw.-hr., or practically the same amount that it is proposed the new plant shall produce. The anticipated power is equivalent to that produced by 4,000,000 tons of coal at 2.4 lb. per kilowatt-hour. Here is a real substitute for coal.

The project is estimated to cost \$75,000,000 to \$100,000,000, and would give employment to 5,000 men for four or five years. With this natural resource harnessed and producing cheap power, Maine may become a great industrial center. Further, the exportation of power to New Brunswick, New Hampshire, and Massachusetts, and not overlooking the possibility of eastern New York, less than 500 miles distant, should return to the state a splendid revenue and dividends to the promoters. Should success crown this venture, there are other places along the coast of Maine, as, for example, at Portland, where the average tide is 8 ft. 11 in., where other plants could be installed to furnish additional power for long-distance transmission. The average tide at Seattle is 11 ft. 4 in., and at Balboa, Panama, 12 ft. 6 in., where great plants for harnessing the tidal energy

could be located and power transmitted for great distances.

Long-distance transmission of electric current on copper conductors at high voltage has not reached its limit. The day of "white coal" is dawning, and with it may come the smokeless city, a reduction in manual labor, an elimination of coal-mining hazards and the end of uncertainty of coal supplies due to such conditions as exist in Pennsylvania today.

The Mining Engineer of the News

ACCORDING to newspaper reports, three men, "a widely-known mining engineer," "a well-known mining expert" and one "widely known in mining circles," have committed suicide within the last few weeks. Inquiries among the fraternity and consultation of "Who's Who in Engineering" and membership lists of the American Institute of Mining and Metallurgical Engineers, failed to identify these men with the profession or mining industry. What, therefore, constitutes a widely-known mining engineer? Apparently it is a stereotyped expression used by the average newspaper reporter and applied indiscriminately to a mine promoter, mining stock salesman, mine investor, mining engineer, or to any one in even a small way connected with the industry, or who may perhaps talk more glibly regarding the industry than can the reporter.

Although it was claimed some time ago that there was a depression in the mining industry, we have not heard of any engineers connected with the real mining operations committing suicide. A bona fide engineer is usually sufficiently versatile to adapt himself to other and perhaps more lucrative lines of business, rather than knock at St. Peter's door asking admittance.

The Co-operation of Our Readers

MANY INQUIRIES about every conceivable phase of mining activity come into the *Mining Journal-Press* office, by personal calls, telephone, and the mail. Often, indeed, the questions have only a remote relation to mining, such as one we had last week, asking as to the cost of making chlorine gas in Mexico; and sometimes we can see no reason at all why we have been selected as a font of knowledge. Nevertheless, we are glad to do all that we can to help our readers. Such inquiries as we think are of general interest are published in our "Consultation" department. Where the query is about something that requires a very specialized knowledge, we are sometimes forced to seek the help of our readers, as was the case with one of the questions in both our Oct. 3 and Oct. 10 issues. Fortunately our friends in the field are quick to co-operate and we can thus act as a clearing house of mining and metallurgical information. This spirit of co-operation helps to make *Mining Journal-Press* valuable; practically all the information that you read in these pages is the boiled-down experience of operators in the field, experience gained at the cost of much time and money, and given to us for transmission to their fellow men. Of course, it takes a few minutes to jot down a few comments on something you have read, but your thoughts and information are probably exactly what some of our readers are very anxious to have.



Photo by Hartsook, San Francisco.

A Metallurgical Construction Engineer of Note

Jules Labarthe

1903, he became superintendent of the smelter and refinery, and was placed in charge of the purchasing department for the mines, mills, and smelting operations of the company. In 1906 he became general manager of the smelting and refining operations of the company, leaving the Consolidated in 1910 to become general manager of the Mason Valley Mines Co., a subsidiary of the Gunn-Thompson interests. At Mason Valley, Nevada, he had full charge of the mining and exploration work. He designed and constructed the Thompson smelter. The operations of the Mason Valley company were discontinued in 1914 on account of war conditions. Labarthe next established himself in San Francisco in 1915, as a member of the firm of Bradley, Bruff & Labarthe. He was retained by F. W. Bradley to investigate and report on the smelting of the Bunker Hill ores and concentrates.

JULES LABARTHE, mining and metallurgical construction engineer of San Francisco, was born in Peoria, Ill. He attended high school at Colorado Springs and obtained his first job in the assaying office of John McVicar, of Salt Lake City, in 1893. A year later he was employed in the mill of the Mammoth Mining Co. at Mammoth, Utah. For the next two years he took special courses in metallurgy and chemistry at the University of Utah, employing part of the time and his vacations as draftsman for L. C. Trent & Co., of Salt Lake City. In 1897 he went to Trail, B. C., in the employ of F. A. Hinzie as assayer and draftsman. Hinzie started the British Columbia Smelting & Refining Co., which afterward became the Consolidated Mining & Smelting Co. of Canada.

Labarthe remained in the employ of the new company, where, in conjunction with A. L. Dean, he prepared the plans for the lead blast furnace smelting unit at Trail. He put in a Huntington-Heberlein desulphurizing unit and the first Betts lead electrolytic plant. He was in active charge of the construction work upon the new smelting units at Trail. In 1899 he was advanced to the position of assistant superintendent and metallurgist. In

In 1916, he was given authority to proceed with the design and construction of the lead smelting and refining plant at Kellogg, Idaho. The plant was put in operation in July, 1917. Labarthe selected the staff and was retained as smelter director in charge of ore contracts, freight rates, and the sale of products until the end of 1920. During this period he had charge of the construction of the magnesite plant erected by the Northwest Magnesite Co. at Chewelah, Wash. Preliminary designs for a lead smelting and refining plant were made for the Penarroya Mining Co. of Spain and also for the Burma Corporation. Early in 1921, Labarthe went to China and reported upon the advisability of a metallurgical plant to be situated in the central part of that country.

Labarthe's latest work was the design and construction of a zinc-oxide plant for the Shasta Zinc & Copper Co. and the Magma smelter at Superior, Ariz. Recently he accepted the position of general manager of the Georgian Manganese Company, Ltd., in the Caucasus, which will develop a concession recently concluded with the Russian Government. Labarthe's departure from San Francisco will be looked upon with regret by his many friends.

Commercial Practice in Sampling and Assaying Copper

How Established Customs in the Industry Enter Into Transactions Between the Producer, Smelter, and Refiner

By A. M. Smoot

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THE ELEMENTS of first importance in the evaluation of copper ores and furnace products are copper, gold, and silver. These interest the miner, because they are the elements paid for. But the other principal constituents of ore are of almost equal importance, especially to the smelter, since they affect the smelting qualities; and impurities, if present in proportions above specified limits, increase the smelting charges by way of penalties. Smelters and refiners, therefore, require more or less complete analyses of every ore, matte, or bullion, whereas the producer is interested only in the proportions of valuable metals, unless the smelter or refiner makes claims for excess impurities and exacts penalties.

In the usual course of business the seller has his product assayed only for the valuable metals, leaving the matter of making complete analyses to the smelter or refiner, and checking only those items for which penalties are claimed. As the elements that are to be penalized vary, and smelting charges also vary with local conditions, the producer should know the average character of his product and consider well the terms of his contracts. In comparing offers from two or more buyers, it is advisable to work them out on the average composition. Having compared offers and decided which will be to the best advantage, it is unnecessary to have every lot analyzed for all constituents; this may be left to the smelter or refiner, excepting items directly affecting settlement through the imposition of penalties for undesirable impurities.

As the smelter or refiner knows all the details of his business, and the miner's business is not smelting, advantage in figuring smelting contracts is on the side of the smelter. Unless the miner is familiar with the sometimes complicated details of these contracts, it is advisable for him to employ a broker who, understanding these things, often will be able to compare offers to better advantage.

Accurate sampling and weighing are, of course, necessary preliminaries to assaying for settlement, and these operations are always conducted at the smelter or refinery, usually under the control of a representative of the seller.

WEIGHING OF ORES, MATTES, AND BULLION

The weighing of ores, mattes, and bullion is done on platform, beam, or special track scales at the buyer's works. The seller's representative should be provided with standard check weights so that he may test the ac-

curacy of the weighing apparatus. It is his duty to do this frequently, to see that all sacks or containers are properly emptied, and that tares are taken properly. If ore or matte is shipped in bulk rather than in sacks, it is the representative's duty to examine all cars, holds, or lighters to see that they are well cleaned and that all of the material received is weighed in. Causes of loss of material in transit, such as broken containers, torn sacks and leaky cars, should be noted and at once reported so that proper claims may be made against transportation companies; or, in case such losses occur through fault of the shipper, that they may be rectified in future shipments. Ore and matte may be sampled by hand labor. Small, rich lots usually are sampled in that manner, but the preferable and usual method for large shipments is by automatic machines. All the material in a lot may be put through the sampling plant, but in handling large lots of fairly even grade only a fraction need be crushed and sampled. The particular fraction necessary will depend upon the character of

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the material, the size of the lot, the size of the largest pieces, and the distribution of the valuable metals. Usually from 10 to 30 per cent will be sufficient to yield accurate and representative samples. Whatever fraction may be decided upon by the shipper's representative and the smelter as necessary for a representative sample is deflected to the sampling plant after weighing. This may be done in different ways. If the material is in sacks or other containers, a certain number of these may be set aside as they are discharged. If the material arrives in bulk, every fourth, fifth, seventh, or tenth barrowful or scoopful may be discharged into a sample car for transfer to the sampling plant, the remainder of the material going directly to the bins or stock piles.

The weight of lots to be sampled separately depends upon the grade of the material. Low-grade ores may be sampled in 200-ton lots. Richer ores, and especially those of uneven composition, should be sampled in smaller units; 50 tons, perhaps, is the average unit, as this constitutes about a carload. Rich ores, especially those containing large proportions of gold or silver, should be divided into 25-ton lots. In this country the general use of automatic sampling machines tends toward settlement in large-lot units. In Europe, where hand sampling is the prevailing method, small units, usually not over 25 tons, are taken.

The process of automatic sampling is the same whether the whole lot or a fraction of it is taken. The

material is first crushed to suitable size; then a fraction is automatically cut from the falling ore stream. This fraction is crushed finer, and again the stream is cut, and so on. Usually three or four cuts, with intermediate crushing if necessary, suffice to yield a sample of 200 to 500 lb. at $\frac{1}{4}$ -in. size or finer. This is worked by quartering or by Jones' dividers to the final samples, each division being followed by suitable crushing operations until a final sample of about 5 lb. at 100 to 120 mesh is obtained. This is divided into four parcels—one each for the smelter, seller, umpire, and reserve.

Factors to be considered in machine sampling are, first, the necessity of deflecting the *whole ore stream* in taking the sample cuts. Apparatus that deflects or cuts only part of the ore stream cannot give an accurate sample. Second, the ore stream should be even and regular. For this reason, feeders regulating the flow are useful adjuncts. Third, the cuts should be frequent and small, since frequent cutting is analogous to mixing. Fourth, the necessity of crushing the ore to suitable size before each cut. The conventional reduction in size (largest diameter) is 50 per cent. Thus, if the first cut is 20 per cent at 2 in. this should be crushed to 1 in. before another 20 per cent cut is made and this should be crushed to $\frac{1}{2}$ in. before another 20 per cent cut.

The size-weight ratio—that is, the ratio that the weight of sample should bear to the whole weight of material for any given size of the largest ore pieces—has been worked out by Brunton.¹ Many mechanical sampling plants crush finer at each sampling stage than these calculations indicate is necessary.

If these points have been observed in designing a mechanical sampling plant, there is no doubt that machine sampling is superior to hand sampling, being more economical and more accurate. Moreover, it eliminates personal factors.

MOISTURE

Almost all ores and some mattes contain appreciable proportions of moisture. The assay sample may be dried at any stage of the final work if this is necessary to insure ease in grinding, but the presence of moisture is advantageous, as it prevents dust losses. It may even be advisable to add a little moisture by sprinkling the sample during the final operations. This is necessary in sampling dry, dusty ores when the fine parts are the richer in valuable minerals. The final sample however, should be dried at 100 to 105 deg. C. before it is divided into the several packages.

As practically all ores contain more or less moisture, and assays are made on the dry basis, it is necessary to determine moisture in the whole shipment at the time of weighing. An accurate sample for this purpose is difficult to obtain, because moisture is lost under crushing and mixing operations, but as moisture is usually unevenly distributed, crushing and mixing are necessary to obtain an average sample. The determination of moisture, as ordinarily conducted, is inaccurate; the results tend to favor the seller—that is, they show less moisture than is actually present. This is caused, in the first place, by loss during crushing, and, in the second, because the sample weighed and dried is too small to represent the moisture properly. The usual unit for determining moisture is 10 lb.; in many cases at least 100 lb. should be taken.

The moisture determination works in favor of the seller in another way. Many minerals contain more or less water of combination, part of which may be given off at 100 to 105 deg. C. When the ore is in relatively large pieces, as it always is in the moisture sample, some of this water and even some free moisture is retained unless heating is very prolonged. The assay sample, on the other hand, is pulverized to, say, 100 mesh; this dries more readily and perfectly at the conventional temperature. The analysis, therefore, is made on drier material than the dried moisture sample. Differences caused in this way may, in some cases, amount to 0.1 or 0.2 per cent. This, of course, makes a corresponding difference in settlement.

METAL SAMPLING

The raw material of the smelter is ore or matte. The raw material of the refinery is bullion, which may be either blister copper, the product of the converter, or black copper produced in blast furnaces or in reverberatories. As copper bullion contains practically all the precious metals originally present in the ore or matte from which it was produced and oftentimes additional quantities gained by the use of gold- and silver-bearing ores for converter lining or flux, the accurate sampling of bullion is of the utmost importance. In addition to copper, silver, and gold, copper bullion contains notable proportions of impurities—for example, arsenic, antimony, lead, selenium, tellurium, nickel, cobalt, and iron. Any or all of these may be present in the bullion, although they may be in such small proportions in the ores from which the bullion was made as to be difficult to detect at all. This is true in spite of the fact that some of these elements are, in part, eliminated in the smelter and converter. There is, however, considerable concentration, especially in the case of nickel and cobalt.

The producer of copper bullion, like the ore producer, is interested in the proportions of copper, gold, and silver, but the refiner is also interested in the impurities, as these affect the economy of refining to a marked degree. Penalties for impurities in excess of specified proportions are exacted, but it is only when claims are made by the refiner that the producer need have the bullion examined for impurities.

Because the valuable metals and impurities are very unevenly distributed in the pigs, cakes, or bars in which the metal is cast, and because shipping lots often are made up from several converter or furnace charges which may be widely different in composition, correct sampling of copper bullion is a difficult matter. The so-called template or checkerboard method is employed when sampling is done at the refinery, and experience has shown that, when properly conducted, it is perfectly reliable and fair to both buyer and seller. Other methods of sampling may be employed at the smelter; for example, a "spatter sample" may be taken at the time the metal is cast, but the general standard method is sampling at the refinery by drilling, the drill holes following a systematic course as each succeeding bar is drilled, so that the whole surface space is covered. This is necessary because the crude copper is not homogeneous, the impurities and also gold and silver being present in different proportions in different parts of the same bar. This segregation of impurities follows the same general lines in each bar of the same kind of bullion, so that the richest part in one bar is also the

¹"Modern Practice of Ore Sampling," *Trans. A. I. M. E.*, vol. 40, page 567.

richest part in another, however much the two may vary in the proportions of the several constituents, provided always that the bars are substantially the same in size and contain the same impurities. The template or checkerboard method of drilling is designed to neutralize the errors due to heterogeneous distribution of impurities and precious metals by taking advantage of their tendency to follow the same lines of segregation in each bar.

The top surface measurements of the bars serve as the dimensions of the template. This is divided into a number of equal squares, usually 1 in. square, and a hole is bored in the center of each. The template is applied to the bullion to be sampled, and bar No. 1 is marked through hole No. 1 in the template and drilled at that point. Bar No. 2 is drilled at a point corresponding to hole No. 2, and so on until every bar has been drilled in the place indicated by the corresponding hole in the template. Thus there is only one hole in each bar, but the hole in each bar is in a different position. The mixed drillings serve as a sample of the lot; their further treatment will be outlined hereinafter.

The basis of the template system is simple, but a full understanding of all the details is not easily acquired. The subject has been fully covered in Bulletin 122, U. S. Bureau of Mines, entitled "The Principles and Practice of Sampling Metallurgical Materials, With Special Reference to the Sampling of Copper Bullion," by Dr. Edward Keller. This paper is recommended to those who wish to make a detailed study of the subject.

A few essential points may be mentioned here: All drill holes must extend through the full thickness of the bars. This is important, because silver, gold, and copper are in varying proportions in the different horizontal zones. The top oxidized crusts of argentiferous bars are usually richer in silver and somewhat richer in gold than the solid metal beneath; the top crust is brittle and tends to break into small pieces under the action of the drill. The tops of the bars being rough, some of this fine material is lost in the crevices; it cannot be gathered completely. Samples taken by drilling all the bars from the top toward the bottom do not represent the metal from the exact volume of the drill hole; they are usually somewhat too high in copper and too low in silver owing to loss of brittle rich silver-bearing material. It might be supposed that this error could be rectified by drilling the bars bottom up, because the bottom is usually smooth and has no high silver-bearing oxidized crusts. But another error sometimes occurs when drilling with the bottoms of the bars uppermost on the drill press. As the drill penetrates the rich silver-bearing crusts, areas larger than the drill holes may be broken away. These fall into the sample, thereby increasing the silver content.

Experiments have shown that samples taken by drilling the bars top up weigh less than those taken with the same drill from the same bars with the smooth bottom surface up. It may be that with some kinds of copper bullion there is a tendency for the drill to break

out craters of high-silver crust as it penetrates this crust, but observation of many drilling operations has shown that usually there is more fancy than fact in the case. Rich crusts included in this way are generally less in amount than the rich material lost when the bars are drilled with the rough top surface uppermost. Nevertheless the refineries have capitalized the tendency and have established the custom of drilling alternate lots top up and bottom up.

Although greater accuracy would be attained by drilling all bars with the smooth surfaces up, it must be kept in mind that all copper bullion bars are cast with a bevel so that the top surface is larger than the bot-

tom surface. This form of casting is necessary in order that the metal may be readily removed from the molds. As the bevel can be drilled only from the top, it is necessary that a certain number of top holes shall be drilled in each lot—namely, those that fall in the bevel.

The present custom of drilling lots alternately from top and bottom should be changed and

all drill holes should be taken by drilling with the smooth bottom surfaces uppermost except those holes which fall in the bevels. The template sections should be square or the closest approximation to square which the dimensions of the bars will permit.

The number of bars to be drilled from a lot will depend upon the richness in gold and silver and the variability of these metals in the several converter or furnace charges that make up the lot. In sampling blister low in precious metals, 20 per cent of the bars will suffice unless the tenor of the converter charges varies greatly. In sampling material rich in gold or silver, 100 per cent of the bars should be taken.

HOW LARGE SHOULD SAMPLING LOT BE?

Lot sizes vary with the richness of the material; 100 tons is not too large a unit for copper of fairly uniform composition low in gold or silver. When the copper is variable in grade and rich in gold and silver, 25 or at the most 50 tons should constitute a sampling lot.

In order to arrange a template with the proper number of holes to cover the number of pieces in the sampling lots, the template may be made to cover the whole surface area, or only half or quarter of it. Half of any given bar is practically like the other half, and a quarter is like the other three-quarters. This being the case, quarter, half or whole templates may be used, whichever yields the number of squares necessary to cover the number of pieces in the sample lot. The drills used should be as large in diameter as practicable. The volume of a drill hole varies directly with the square of the diameter. A 1-in. drill will take four times the quantity of borings from a bar of uniform thickness as a $\frac{1}{2}$ -in. drill. The sources of error from extraneous dirt getting into the sample do not vary greatly with the size of the drill hole; about the same amount of surface matter foreign to the exact area of the drill hole gets into the sample whether the drilling be done with a $\frac{1}{2}$ -in. or 1-in. drill, but with the smaller drill it counts four times as much in relation to the weight of drill-

"THE PRESENT CUSTOM of drilling lots alternately from top and bottom should be changed and all drill holes should be taken by drilling with the smooth bottom surfaces uppermost except those holes which fall in the bevels. The template sections should be square or the closest approximation to square which the dimensions of the bars will permit."

ings. The larger the drill the more representative is the sample; but there is a practical limit to the diameter of the drill. The peripheral speed varies directly with the diameter at any given number of revolutions per minute. Thus any point on the circumference of a 1-in. drill, revolving at any given speed, travels twice as fast as a point on the circumference of a $\frac{1}{2}$ -in. drill at the same speed. With the larger drill friction is therefore greater and there is a corresponding tendency to heat. In drilling impure bullion it is not practical to use large drills, because the drill must be driven so slowly to prevent overheating as to interfere seriously with the progress of the work. Twist drills $\frac{1}{2}$ -in. in diameter are usually employed, but $\frac{3}{4}$ -in. drills may often be used with better results.

GATHERING THE DRILLINGS

The drillings should be swept through the drill holes when the drill is withdrawn rather than be gathered from the surface of the bar. Extraneous matter is invariably included when one attempts to gather the drillings by brushing them to a scoop; moreover, it is impossible to gather all the drillings when the surface of the bar is rough, but more may be conserved by poking them through the drill holes without spreading them over a wider area of rough surface. All bars should be brushed clean before drilling, as adhering dust is unimportant in relation to the whole weight of the bar, but a little extraneous dust in the small weight of drillings is important.

The drillings from the usual sampling lots may weigh from 15 to 50 lb., depending upon the number of pieces drilled, the thickness of the pieces, and the diameter of the drills. Before division into the several assay samples they must be reduced to suitable size. This is done by grinding in a toothed mill. The usual form of mill is known as the Hance drug mill. The soft iron grinding plates of this mill are sometimes replaced by chrome steel plates, but this is unnecessary, as practically no iron is taken up in grinding copper turnings, even in mills with soft iron plates. After the first few pounds of turnings have been ground, the plates become coated with copper.

BORINGS GROUND TO 8 MESH

All the borings from every lot are ground until they will pass an 8-mesh sieve. They are then thoroughly mixed and divided on a Jones divider or other suitable splitting device, until about 5 lb. is obtained. This is again ground by repeatedly passing it through the same mill until all will pass a 20-mesh screen. The fine borings are then weighed and screened through a 40- or 60-mesh screen. The part finer than 40 or 60 is weighed and the percentage of coarse and fine is calculated. The final samples are made up, each consisting of two packages—one of coarse and the other of fines, with the record of the proportions marked on each package. The coarse is richer in copper, and, as a rule, much poorer in gold and silver than the fine. The analysis samples are weighed out by taking proportionate parts of coarse and fines in accordance with the data shown on the sample packages.

In recent years the determination of moisture in blister copper has become an important factor in assaying for settlement; it is still a frequent source of dispute between smelters and refiners. Years ago few

refineries realized that considerable proportions of moisture could be present in metal that appeared to be solid and showed no external evidence of water. None of the producers believed it; they objected strenuously to deductions for moisture except for a small weight allowance on blister that had been exposed to the weather and was obviously wet when it was weighed. W. H. Peirce was the first to discover the importance of a moisture allowance on bars that seemed to be dry. He observed that drillings from dry copper bars were frequently quite wet and that the drill holes sometimes yielded large quantities of water. Further, if water were poured on a dry gas-finished bar, it soon disappeared and the bar seemed quite dry.

The fact is that all blister copper that has been exposed to the weather contains moisture, even when it appears to be dry, and all blister that has been bosh-cooled contains water in deep-seated cavities which is extremely difficult to remove. The cavities connect with the outer surface only by capillaries. These sinuses in the aggregate hold considerable water, but there is seldom external evidence of it.

Superficial moisture absorbed in the immediate surface through exposure of the blister to snow or rain may be removed by short heating to a temperature of 130 deg. C., but the deeper seated moisture absorbed during bosh-cooling requires long heating at a temperature of about 230 deg. C. to remove it completely.

Owing to the uneven distribution of moisture in blister copper, it is difficult to obtain an average sample representing any particular lot; in fact, the only possible course would be to dry the whole lot. This is impracticable. The average results of a number of lots, however, undoubtedly give a fair representation of the moisture contained covering shipments over a considerable period of time.

DRYING THE BLISTER

The usual procedure is to heat about 10,000 lb. of the blister in a specially constructed oven to a temperature of about 230 deg. C. for at least six hours. The number of bars in this weight will be between sixteen and twenty-four, depending on the size and thickness of the individual pieces. The blister is contained in steel frame cars, which are weighed with the copper before and after heating. The cars are run directly into the drying oven, and it is needless to say that they should have no lubricants on wheels or any combustible matter such as packing connected with them.

The drying ovens are constructed so that the products of combustion from oil burners or furnaces pass over the copper, the firebox being at one end of the oven and the flue at the other. This practically amounts to drying in an enlarged chamber of a flue. The temperature is observed by thermocouples and is regulated by hand control. The average loss in bosh-cooled copper that has not been exposed to weather is between 0.1 and 0.3 per cent. Occasionally, lots which contain large cavities under the surface may show moisture as high as 1 per cent, but this is largely due to exposure to rain or snow.

Settlement assays for copper, whether in ore, matte, or blister, are usually made by the electrolytic method, although the iodide method is sometimes used, especially for low-grade material. Most contracts, however, specify

the electrolytic method. It must not be supposed that this simply means solution of the copper-bearing material in acid, followed by electrolytic precipitation of the copper from the solution. Small amounts of impurities, such as antimony, bismuth, selenium, and tellurium, present in the acid solution invariably contaminate the electro deposit of copper and the results are therefore too high. Some ores and mattes contain copper that is insoluble in acids, but this is comparatively rare. Unless prior experience has shown that all the copper in certain brands of ore dissolves readily in acid, it is essential to examine the insoluble residue by fusing it. It is also necessary when dealing with impure material to remove the impurities before electrolysis to obtain correct results. This is usually done by precipitating the copper as cuprous sulpho-cyanate, which separates it substantially from all impurities that are likely to contaminate the electro-deposited metal. The sulpho-cyanate precipitate is calcined and the residue is dissolved in acid. This solution is electrolyzed.

There are other methods of purification that are equally efficient and sometimes are better adapted to purification of particular ore than the sulpho-cyanate method, but it is unnecessary to go into details here. It might be emphasized that if impurities are present which are likely to be deposited with the copper, precautions must be taken to remove them.

It is not usual to specify the details of assay methods in contracts for purchase or sale of copper materials; this may safely be left to the chemist. It suffices to state that copper shall be determined electrolytically.

SETTLEMENT ASSAYS—SILVER

Silver in ores and mattes is usually determined by the scorification method, but this is not always reliable, as the presence of some impurities and of much copper is detrimental to accuracy. In ores rich in copper, repeated scorifications or small initial charges with relatively large amounts of lead are necessary in order that the lead buttons may be free enough from copper to cupel properly. Crucible assays with a large excess of litharge in the flux are sometimes preferable to scorification. In mattes high in iron, preliminary treatment with dilute sulphuric acid will dissolve the ferrous sulphide without dissolving any silver. The residue from the sulphuric acid treatment is available for either scorification or crucible assay. Some furnace and wet process products high in silver must be assayed by "combination" methods. In these the assay charges are dissolved in nitric or sulphuric acid and silver is precipitated as chloride or bromide from the solution. The solution is then filtered and the silver compound, together with the insoluble residue, is treated by scorification or crucible methods.

Although it is true that the majority of low silver-copper ores may be assayed accurately by scorification, the practice of specifying this method for all ores and mattes is objectionable.

Gold in ores, and sometimes in mattes, is usually determined by crucible assay. This method is usually specified in the contract, since the proportion of gold is frequently small, and as the splitting limits are narrow, it is necessary to work on large charges, the ordinary practice requiring 0.5 A.T. At least four assays should be made, the gold being weighed from each charge and then cumulatively. It is better practice to make six or eight assays and to scorify the lead buttons from two or more crucible charges together; this is essential when the smelter pays for all gold if it is over a specified limit, say 0.02 oz. per ton, and nothing when it is less than the specified figure.

Some mattes contain large proportions of gold together with impurities which make accurate gold assays by the crucible method impossible. In these cases special methods, usually some form of combination assay, should be used. The most widely applicable of these is the crucible-combination method. In this method the lead buttons from crucible fusions are dissolved in dilute nitric acid and the insoluble gold is filtered off, scorified, cupelled, and parted.

No gold dissolves if the nitric acid is dilute and if the solution is kept cool while the lead is dissolving. It is essential, however, to add at least ten times as much silver as there is gold to the scorifier. This serves as a collector, furnishes a bead suitable for parting and prevents undue loss of gold in cupellation.

DETERMINING GOLD AND SILVER IN COPPER BULLION

Gold and silver in copper bullion are usually determined by the sulphuric acid combination method. In this method the metallic copper is first amalgamated by treatment with a mercury solution, then the copper, or most of it, is dissolved by heating the amalgamated metal with strong sulphuric acid. The copper sulphate is dissolved in water and the solution filtered. Gold and silver remain in the insoluble residue; this is scorified and cupelled. Since nearly all the copper and some of the impurities pass into solution on dissolving the copper sulphate in water, only a short scorification is necessary. This method is excellent for gold determinations. It is limited in its application to silver assays to those grades of bullion which do not contain an excessive proportion of impurities and where the proportion of silver is not in excess of about 80 oz. per ton. If the proportion of silver is large, or if the impurities are excessive or of such a character that they are not eliminated in solution, the silver results tend to be too low. In the first case, some silver dissolves and is not reprecipitated either by the small proportion of metallic copper remaining unattacked by sulphuric acid or by the lower oxide compounds of sulphur generated in the acid attack. In the second case, either the impurities may remain in the insoluble residue as such and cause losses in the subsequent scorification and cupellation, or they may form combinations with copper which are not readily attacked by hot sulphuric acid, whereby the insoluble residue contains so much

"FACTORS to be considered in machine sampling are, first, the necessity of deflecting the whole ore stream in taking the sample cuts. Apparatus that deflects or cuts only part of the ore stream cannot give an accurate sample. Second, the ore stream should be even and regular. For this reason, feeders regulating the flow are useful adjuncts. Third, the cuts should be frequent and small, since frequent cutting is analogous to mixing. Fourth, is the necessity of crushing the ore to suitable size before each cut."

copper that it cannot be removed by short scorification, and the lead button is unsuitable for cupellation on that account.

Silver in crude copper rich in silver may be determined by the nitric acid combination method. In this method the metal is dissolved in nitric acid, which dissolves the silver also. Silver is precipitated as chloride or as bromide from the suitably diluted solution. The insoluble silver compound is removed by filtration, scorified with lead and cupelled. The nitric acid combustion method is applicable to all grades of copper bullion except those containing excessive amounts of tin or antimony.

Gold should not be determined on the same portion as that used for silver. Some gold is lost in the nitric acid treatment and the gold assays are almost invariably too low. When the nitric acid method is used for silver, gold should be determined separately either by the all-fire method or the sulphuric acid combination method.

In the all-fire method a number of small charges, usually $\frac{1}{4}$ A.T., are repeatedly scorified with a large excess of lead and some silica. The scorifications are repeated until most of the copper is eliminated and the lead buttons are soft enough for scorification. This method is excellent for gold, but is not suitable for silver, some of which is lost in the long scorification operations.

CORRECTED ASSAYS FOR GOLD AND SILVER

All smelters and refiners and almost all the sellers of gold and silver-bearing copper ores and furnace products know that losses occur in assaying for gold and silver which are not accounted for in every-day practice. This is so well understood that unless contracts call for corrected assays, the so-called commercial assays always apply unless the material is so rich in gold and/or silver that these are by far the predominantly valuable constituents. There is no generally accepted limit of value above which corrected assays apply. Although settlements are usually based on commercial (uncorrected) assays, smelters and refiners take assay losses into account in figuring their metallurgical balance sheets. Some contracts specify corrected assays for settlement purposes. In these cases the smelter or refiner makes a higher smelting charge or higher toll charge or pays less for the precious metals than when commercial assays govern the settlements. The producer always pays, no matter how the contract is made in regard to corrected assays.

The usual procedure in making assay corrections is to make the assay in the ordinary way and to re-assay the slags and cupel bottoms for the small proportions of gold and silver contained in them. The amount obtained is added to the results of the straight assay. This procedure introduces an error which will be shown. Sometimes, in assaying very rich and comparatively pure material, it is possible to make corrections by conducting check assays. The charges for these are made from pure metals to represent approximately the composition of the material under assay. Whatever loss in precious metals the checks sustain in the assay is added as a correction to the assay of the sample which is conducted parallel with the check. This method is generally used in the assay of silver doré; it has only a limited application in the assay of copper bullions and

is not used at all in the assay of ore and mattes, since it is impossible to make artificial check samples approximating in composition the material under assay.

CUPEL ABSORPTION CHIEF SOURCE OF LOSS

In the ordinary assay method the principal source of loss is cupel absorption; only a little silver and practically no gold is dissolved in slags. Volatilization loss in scorification and cupellation is almost inappreciable, provided cupellation is conducted at the proper temperature. The cupelled beads, however, are not pure silver-gold alloy; they always contain lead and other impurities. Silver-gold beads produced by cupellation in ordinary assay practice average 0.992 to 0.995 fine; the remaining 0.8 to 0.5 per cent is principally lead.

Some silver and gold is carried into the cupels. The results of commercial assays, therefore, represent a balance of errors between silver and gold absorbed in slag and cupels and lead and other impurities retained in the silver beads. The amount of lead retained is less than the amount of precious metals absorbed by the slag and cupels. Commercial assays therefore show a deficiency; that is, they are less than the true silver-gold contents of the material under assay. How much less depends upon many factors, principally upon the weight of silver and gold in proportion to weight of lead in the buttons to be cupelled. The average difference between corrected assays made by the re-assay of slag and cupels and the uncorrected assay of the same material is approximately 1.8 per cent for silver; it is less for gold if the gold is low in proportion to silver in the cupelled bead. This applies to beads weighing from 60 to 120 mg. cupelled from a 12- to 15-gram lead button. In smaller silver beads, cupelled from the same weight button, the loss is greater and may amount to 8 per cent. Thus a 5-oz. ore assayed on a 1 A.T. charge, yielding a 5-mg. bead, may show only 4.6 oz. A 500-oz. ore assayed on 0.5 A.T., cupelled from the same size button, might show a difference between corrected and uncorrected assays of 6 oz., or 1.2 per cent. The proportionate differences are variable and depend upon the skill of the assayer, but these figures serve to illustrate that what may be called "apparent" corrections are variable, depending upon the tenor of the material under assay.

CORRECTED ASSAYS APT TO BE TOO HIGH

It will be seen that while uncorrected assays are nearly always below the true precious metals contents of any ore or furnace product, corrected assays, made by re-assaying cupels and slag, are likely to be above the true contents. The reason for this is that, as the cupelled beads obtained in the straight or commercial assay always contain more or less lead, their weight compared with pure gold-silver is too high. To this weight is added the silver-gold recovered in re-assaying the slags and cupels, which also contain lead. It is true that the assay of the slags and cupels is subject to some loss and that there is a slight volatilization loss on both the original assay and the re-assay of the slags and cupels. These factors together, however, cause less aggregate error than the lead retained in the weighed beads. Corrected assays as usually conducted are a little nearer the truth than uncorrected assays, but the error is in the opposite direction. Smelters and refiners who figure their metallurgical losses on the basis

of corrected assays without making allowance for lead in the assays charge their plants with precious metals that are not there. The balance sheet therefore shows fictitious metallurgical losses. In figuring smelting charges, toll charges, payments for precious metals, and the like, based on assays as compared with out-turn, the result is too high and the producer in the end pays the difference. For these reasons it seems that it is a mistake to insist on corrected assays for settlement. The extra charge is likely to be based on erroneous data and the buyer always protects himself by additional charges based on his particular experience.

Contracts for the purchase and sale of copper ores and furnace products usually contain specific limits within which the results of buyers' and sellers' assays may be averaged or "split" for the settlement figures. These vary with the nature of the material and its tenor. Usual limits for low-grade ores are: Copper, 0.1 per cent (sometimes on special contracts 0.05 per cent); silver, 0.3 oz. per ton or less; gold, 0.02 oz. per ton or less. Usually gold is paid for only if it equals or exceeds a specified figure; this may be 0.02 or 0.03 oz. per ton. Silver is not paid for if less than 1 oz. per ton. In ores of higher grade, the limit for silver differences may be increased to 0.5 oz. or even 1 oz.; gold, to 0.03 oz. per ton.

In mattes the conventional splitting limits are: Copper, 0.2 per cent; silver, 1 per cent of the silver content, or 0.5 oz. per ton; gold, 0.03 oz. per ton. In blister copper the usual limits are: Copper, 0.2 per cent; silver, 0.3 to 1 oz., according to richness; gold 0.02 or 0.03 oz. In some blisters very high in gold, the splitting limit is placed at 0.05 oz. Copper differences are sometimes limited to 0.10 per cent, but this practice leads to a large number of umpires without materially increasing accuracy, since averages of both buyers' and sellers' results usually agree within 0.01 or 0.02 per cent.

DEDUCTIONS

Not all of the metals found by assay are paid for. The actual assay results are subject to deductions supposed to cover metallurgical and other losses sustained by the smelter or refiner. In ores and mattes the conventional deduction for copper is 1.3 per cent from the actual assay, but this varies with the smelter and with the character and richness of the ore. Sometimes a deduction of 1 per cent is agreed upon; occasionally the deduction may be as high as 1.5 per cent. Silver is usually paid for at 95 per cent of the silver value, equivalent to a deduction of 5 per cent. Gold, in the East, is paid for at \$20 per Troy ounce; in the West, a lower figure, usually \$19 an ounce, is accepted. In contracts for the sale of blister copper, low limits for copper are usually specified; in high-grade blister 99 per cent is a usual figure. Blister running below this incurs a heavier refining charge or a heavier deduction for loss in treatment.

A deduction is not made from the assay as in ores

or mattes, but an allowance of 5 lb. of copper per ton of blister is made by the seller to cover losses in refining. This figure varies with different refineries and with different grades of blister. Silver is paid for at 95 per cent of the uncorrected assays. Gold is paid for at \$20 per ounce without deductions. In blister containing only small proportions of silver and gold, these metals are not paid for, but a lower refining charge which allows something for the precious metals is sometimes made.

While it does not pay to refine electrolytically low silver-gold blister by itself, such metal is frequently desired by the refiners to dilute highly argentiferous copper and thus to make anodes of gold and silver tenor economically favorable to the prevailing conditions.

Electrification of Nigerian Tin Mines

Hydro-electric power is to replace oil engines in the tin mining operations of Northern Nigeria (Bauch) Tin Mines, according to *The Statist*. In the completion of the scheme a

departure has been made from the original idea, and instead of two 750-hp. Pelton turbine water wheels with generators being fixed, four 500-hp. wheels and generators have been installed, which it is thought, will allow of a better distribution of the water supply. The present requirements are estimated at about 1,000 hp., but the exact requirements will depend upon the number of field motors—operating gravel pumps—which are at work.

At present the company has two motors in operation, while a third has been ordered, and is about to be dispatched to the property. The estimated cost of electric power is $\frac{1}{2}$ d. per cubic yard, compared with $3\frac{1}{2}$ d., the cost of using oil engines. The deposit being worked is some 70 ft. in depth, of which the average "over-all" value is over 2 lb. per cubic yard. Some 30 to 40 ft. of the overburden is, however, unpayable, the remainder containing the concentrates. A short time ago a 200-hp. oil engine was erected to wash down and pump away the valueless overburden, but, after getting down a certain depth, the lift proved too much for the power available, and the work had to be suspended on this account.

The work has been restarted with electric power, and the company has been able to reach the bottom stratum, which largely accounted for the increase in output from 40 tons in July to 110 tons in August. With regard to the future, the monthly output will depend upon the season of the year, but a conservative estimate is a production of 1,000 tons of concentrates per annum, with costs at about £85 per ton and with tin selling at £200.

Royalty and smelting charges vary in accordance with the price of the metal, so that, with tin at a higher price, costs would increase. However, it appears fairly safe to estimate that, with tin at £250, costs would not exceed £100 per ton, which, with 70 per cent concentrates, would show a profit, under those conditions, of £75 per ton.

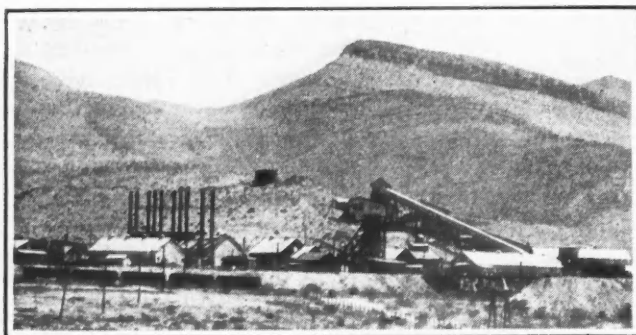
"CORRECTED ASSAYS as usually conducted are a little nearer the truth than uncorrected assays, but the error is in the opposite direction. Smelters and refiners who figure their metallurgical losses on the basis of corrected assays without making allowance for lead in the assays charge their plants with precious metals that are not there. The balance sheet therefore shows fictitious metallurgical losses. In figuring smelting charges, toll charges, payments for precious metals, and the like, based on assays as compared with out-turn, the result is too high and the producer in the end pays the difference."

The Shattuck-Arizona Mill

Ore Treatment Has Been Revised on Basis of All-Flotation and Elimination of Tables

By **George J. Young**
Associate Editor

PROGRESS in flotation treatment can often be more clearly shown by comparing mill operations in the same concentrator at different periods. Recently I visited the Shattuck-Arizona Copper Co.'s mill near



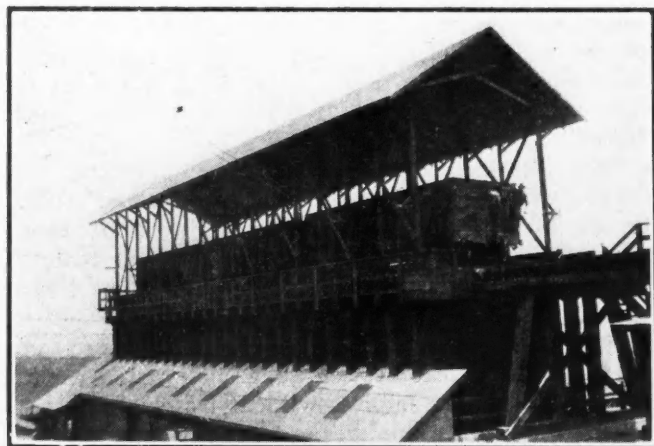
General view of Shattuck-Arizona Copper Co.'s concentrator near Bisbee, Ariz.

Bisbee, Ariz. This plant is of interest chiefly because an oxidized lead ore has been successfully treated there by sulphide filming followed by flotation. In October, 1920, Glen L. Allen¹ described the mill design and the ore treatment at the Shattuck-Arizona plant. The method of treatment was, in brief: Screening, after preliminary crushing by rock breaker and rolls, upon a 4-mm. screen, the undersize being concentrated upon primary tables and the oversize being ground in two 6x4½ Marcy mills in closed circuit with rake-type classifiers. The overflow was received in Allen cones, joining the tailings product of the primary tables after it had been passed through an Allis-Chalmers ball tube mill in closed circuit with a belt-type drag classifier. The underflow of the Allen sand cones was concentrated upon secondary tables (Butchart) and the tailings product sent to an Allen cone, the underflow being treated upon a third pair of tables, which delivered a finished concentrate and a middling that was sent to the tube mill. The overflow of the three Allen cones was sent to a thickener, the thickened product of which was mixed with sodium sulphide and the flotation reagents, and sent to an agitator. From this it was distributed to six K. & K. and two Rork flotation cells arranged in four series of two 10-ft. cells each. The flotation froth of the first cell in a series was sent to the dewatering tank as finished concentrate and the froth from the second cell was returned to the agitator. The thickened concentrates were further dewatered by filtration. The mill handled in 1920 at a rate of about 300 tons per day and the ratio of concentration was 6½ to 1. The recoveries for the year 1920, including the clean-up at time mill was closed down in December, 1920, were 91.4 per cent of the lead, 65.06 per cent of the silver, and 69.4 per cent of the gold from an ore carrying 5.5 per cent lead, 5.5 oz. silver, and 0.06 oz. gold per ton. The design and the practice represented at the time a rationale that was logical and in accordance with the metallurgical thought of the day.

The mill was shut down in December, 1920, after the

treatment of 200,000 tons. Operations were resumed in 1925. The treatment method was revised later on the basis of all-flotation and the elimination of table separation. The present tonnage is 4,500 tons per month. The ore is crushed to ½-in. size and fed dry to the two Marcy mills in closed circuit with two classifiers. A 10 per cent solution of sodium sulphide is fed into the classifier overflow, and the coal-tar reagent is fed into the ball mills. The classifier overflow is received in a Saffold agitator (a new Groch flotation cell was being installed to take the place of the mixer) and the pulp is discharged into the K. & K. flotation machines in parallel. These produce a finished concentrate and a tailing, which is sent to the Rork cells for secondary treatment. A clean tailing is produced and sent to waste, the flotation concentrate being sent to another cell, which produces a finished concentrate and a tailing, which is returned to the primary cells. The flotation concentrates are dewatered and filtered, no changes having been made in this part of the plant.

As a result of the simplified flow sheet, the following equipment was discarded: Allis-Chalmers ball tube mill and drag classifier, six concentrating tables, four Allen cones, and one thickener. The present concentration ratio is 7½ to 1. Lime is fed to the ball mills in the proportion of 1 lb. to the ton. The recoveries of heads as of the same value as were treated in 1920 are: Lead, 90 per cent or better; silver, 65 per cent



Unloading ore at the Shattuck-Arizona mill

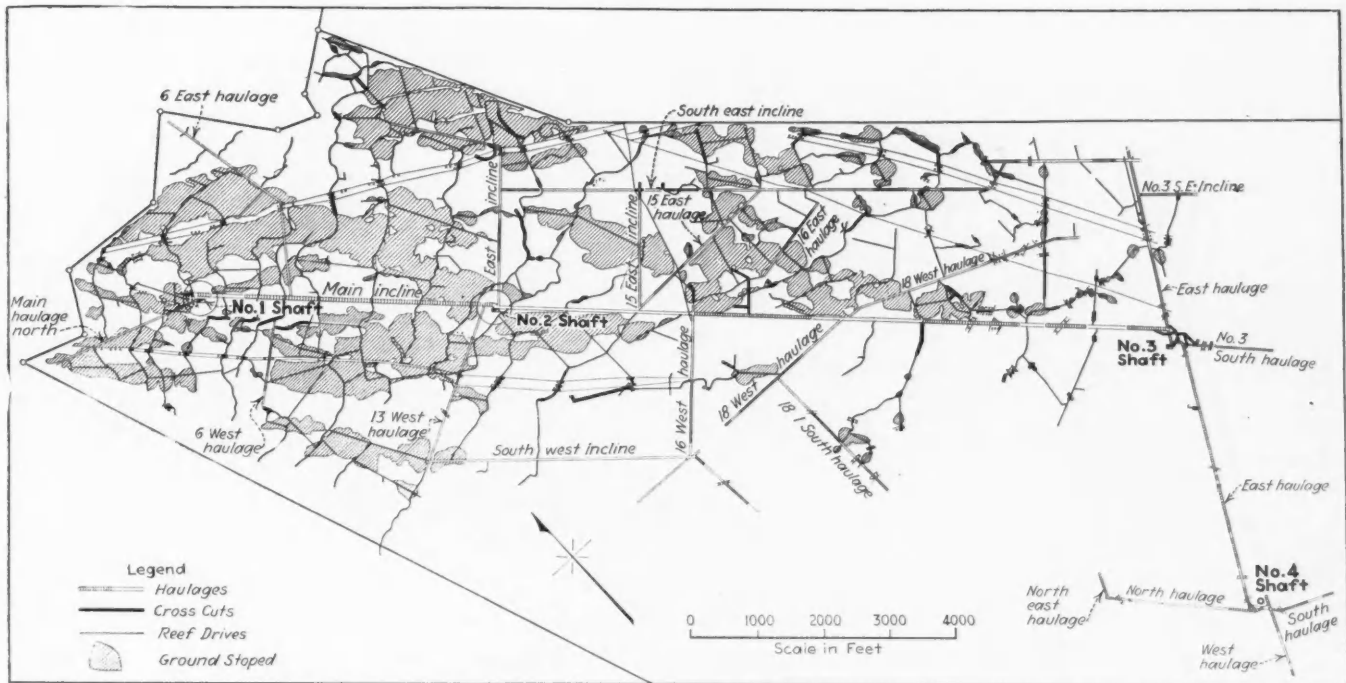
or better, and gold, 75 per cent or better. The gold and lead percentage recovery is increased with an increase of these metals in the ore, but the silver percentage recovery does not increase with an increase in the silver content of the ore. The new arrangement effects a saving in power, water, repairs, and mill attendance, and results in a milling cost on 4,500 tons per month somewhat lower than was obtained when 9,000 tons per month was treated.

The present operations are in charge of I. H. Stanley. T. O. McGrath is general manager of the company's mine and mill. Acknowledgment is made of their courtesy.

Russian Asbestos Production Increasing

Production of asbestos in the Russian Soviet Union for the current fiscal year ended Sept. 30 has been about 10,000 metric tons, or about half of the pre-war output, according to the Sept. 15 issue of the *Russian Review*. Production last year was 3,300 metric tons.

¹*Engineering and Mining Journal*, vol. 110, p. 759.



Plan of workings of Brakpan Mines, Ltd. This property is typical of the flat-lode mines of the Rand

A Journey to South Africa—IV

Population of the Rand—Extent of the Lode—the Brakpan Mine—the West Springs Mill—
A Visit to Pretoria

By T. A. Rickard

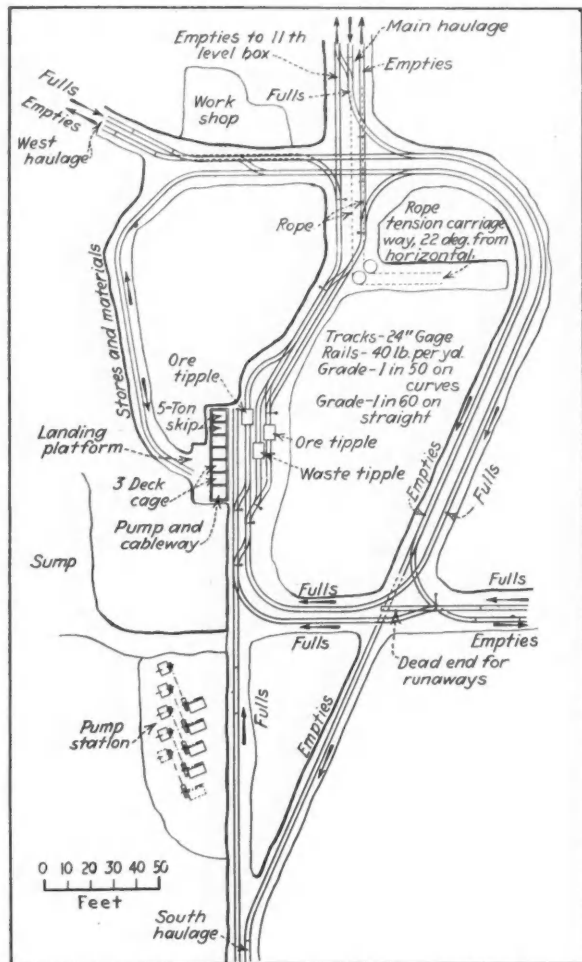
JOHANNESBURG has a population of 150,000, we were told; but, as is usual in South Africa, no mention was made of the natives, who usually outnumber the whites. The population of the Union of South Africa (which includes the Cape Colony, Natal, the Transvaal, and the Orange Free State) is 7,000,000, of whom only 1,500,000 are of European blood. On further inquiry, I found that Johannesburg, as a mining center, with its suburbs, has a population of fully 500,000. The city has the aforesaid 150,000, plus 130,000 colored people, including negroid half-breeds and Asiatics.

At the mines 180,000 natives are employed, together with 19,000 whites, chiefly skilled artisans and overseers. They are engaged in mining gold from a lode, or reef, of conglomerate that has been stoped continuously from the Durban Roodepoort Deep mine in the west to the Simmer & Jack mine in the east, a distance of 22 miles; but the extension of the lode does not cease at these points, for, including breaks in the continuity, the mines along the Main Reef stretch for a total distance of 62 miles. Twenty-one miles east of Johannesburg there is a gap of 4 miles between the Cason and Kleinfontein mines, and east of the latter is the district known as the Far East Rand, from which now comes 70 per cent of the gold output. In this area the gold ore is covered by coal measures, so that in earlier days no outcrop served to stimulate prospecting or development, which ensued only when the diamond drill disclosed the existence of a remarkable synclinal structure. The Brakpan farm was worked for coal thirty years ago, and until 1907. The Apex coal mine, a mile distant, is still active. The

greatest gold mines in the world, the New Modderfontein and Government Areas, are in this part of the Witwatersrand. In March, the month preceding our visit, the New Modderfontein produced 64,043 oz. and the Government Areas 71,039 oz. of gold. I ought to add that the Crown Mines, a big consolidation of companies in the Central Rand, produced 72,578 oz., so that it was actually the most productive of the thirty-eight companies producing. At the eastern end of the gold field the strike of the gold-bearing conglomerate makes a circular sweep southward, with a flat dip, so that a shallow syncline, or basin, is formed. Thus the bed of "banket"—or almond rock, as the Boers named the conglomerate—that is worked in the Sub-Nigel mine eventually will connect with that which is being exploited in the Springs mine, although the horizontal distance is fully 10 miles.

One of the typical mines in this Far East area is the Brakpan, which I selected for a visit because the manager, Mr. Charles B. Brodigan, is a friend and fellow graduate. Our party of three was not disappointed; he put us in the favored-nation category and showed us the utmost hospitality, mental and physical.

The Brakpan is worked through three shafts, 3,100, 3,700, and 4,450 ft. deep respectively; they are in line, the distance between the collars of No. 1 and No. 3 shafts being 18,500 ft., or about 3½ miles. The property covers an area 6 miles long by 2 miles wide. We descended the No. 3 shaft to the bottom, where we saw the belt conveyor that brings the ore and waste from a pocket (placed 150 ft. away from the shaft) to the skip pocket, or shaft-service bin. The station is in



Arrangement of station and tracks, No. 2 shaft of
Brakpan Mines

bad ground, owing to a quartz-porphry dike that has broken the quartzite; therefore the main ore pocket is placed safely outside this insecure ground. We walked down the main incline (See Map, p. 613) to level No. 22 west, and through the 22 (1) west stope to the 21st level, where we saw a development end; thence we went back to the main incline, and so southward returning to the shaft.

The haulage underground follows coal-mining practice, using an endless-rope system, and restricting the incline to 8 deg., within which limit it is possible to continue close to the lode, which dips at an average of 5 deg. throughout the workings. Wide stretches of ore lie horizontal. I add the illustration above to show the arrangement of the station and tracks of the No. 2 shaft, as given by W. L. Honnold in a paper entitled "Mining Conditions on the Witwatersrand," contributed by him to the American Institute of Mining Engineers in 1915. Mr. Honnold, I may add, was manager and consulting engineer, successively, to the Brakpan Mines company, and to him largely is due the successful development of the enterprise.

The gold is concentrated in oreshoots having a nearly parallel strike to the northwest. Somewhat less than half the banket can be mined profitably, the limit of so-called "pay-ore" being represented by 250 inch-pennyweights—say, a width of 67 in. averaging 3½ dwt. per ton. The working cost is 19½s., of which 2½s. goes for development and 3½s. for milling. One shilling equals 25c., roughly. The total yield is 33s., of which

14½s. is recovered by amalgamation in the course of stamp milling, plus tube milling, while 18½s. is recovered by cyanidation.

During the month previous to our visit the Brakpan produced 30,792 oz. of gold. In the year 1924 the tonnage milled was 898,250, from which 349,326 oz. of gold was obtained. The average yield was 7.77 dwt. per ton, which happened to be slightly better than the average of the mine. The ore reserves are estimated at 2,848,540 tons, with an average stoping width of 69.59 in. and an average assay of 7.55 dwt. per ton. The metallurgical recovery in 1924 averaged 95.02 per cent. The dividends were £459,000, besides the government's share of profit—namely, £101,477.

We saw a typical stope; four natives and one white were using two machine drills; each "boy" operates the drill for four hours at a stretch. An average of fifty tons is broken per machine-shift. The work is so severe—owing to the concussion—that four hours is considered long enough; besides, it is not considered desirable that the native should earn excessive wages. He is paid one penny (two cents) per foot of hole; the white boss gets 15s. per shift and from 2½ to 4s. per fathom (36 sq.ft.). Two "boys," or natives, will drill twenty to thirty holes of 4 ft. per shift, and earn average wages of 5s. The white man averages 30s. (\$7.50) per shift. On development work he makes 35s.

The steel is all ¾-in. round; the starter, for 2½ ft., has a 1¼-in. bit; the next foot is done with a 1½-in. bit, and the finishing of the hole to 5 ft. is done with a chisel bit of 1 in. Before the strike, in 1922, the average rate of stoping in the Brakpan was half a fathom per machine drill; now it is 2.96 fathoms. In some of the Rand mines, under especially favorable conditions, as much as four fathoms per shift is done. The average output of the stopes on the Rand is thirty-five to forty tons per machine drill, the best work being done in the New Modderfontein, where, under exceptionally favorable conditions, an average of 6.72 fathoms is broken per machine-shift. In that mine two natives work on each drill; a third native carries the steel, and a fourth is occupied in preparing the tamping and cutting the fuse.

The native begins the hole by holding the drill in his hands, then he rests it against his thigh, and later he lies on his back, holding the drill with his feet, and pushing it then by means of his feet, which rest upon a piece of boiler plate attached to the machine for this very purpose. I add the photograph on page 617 given to me by Mr. Charles H. Davis, of the Ingersoll-Rand Company, to illustrate this operation, which I watched myself with keen interest. The white boss tells the native where to start the hole, and helps him when in difficulty.

The backs of the stopes in the Brakpan are sustained by rectangular sties, or cribbing, 8 ft. apart, filled with waste, and sometimes even with ore, if waste is not handy, such ore being recovered when the ground is worked out finally. Along the haulageways it is customary to leave 60-ft. pillars, but none is left in the stopes. Packs of waste are constructed where a supply of such rock is convenient. Mr. Honnold has stated, in a report written in 1921, that the ideal way to develop a flat-lode mine, like the mines of the Far East Rand, is to establish a system of main levels for transport along the strike of the ore formation. Then the raises and winzes would follow the dip, and would cover the

shortest distances between two main transport levels. Such a system could be perfect if the oreshoots were parallel to the line of dip, because in that case the extension of the main headings between the orebodies would be reduced to the minimum, while the drainage of the stopes would be effected without artificial assistance. Unfortunately, however, such a system of haulage cannot be devised with confidence until sufficient knowledge of the structural geologic conditions underground has been obtained by means of preliminary development on a fairly large scale.

The West Springs mine, where we were received in a most kindly way by the manager, Mr. B. D. Bushell, is adjacent to the Brakpan; it is particularly interesting on account of its new mill, which embodies the latest ideas in the winning of gold from the conglomerate. The designing of this plant, I believe, has been mainly in the hands of a Californian, Mr. Fred Wartenweiler, but the ideas that it embodies are the result, in large measure, of careful experimentation by a group of engineers, Messrs. Carl R. Davis, J. L. Willey, and S. E. T. Ewing, whose research is described and discussed in a paper contributed by them recently to the American Institute of Mining and Metallurgical Engineers, and first put into practice in the neighboring mill of the Springs Mines, Ltd. The main feature of the design of both mills is the facility provided for the greater comminution of the ore by means of tube mills. The first of these was introduced on the Rand in 1904; since then it has been found increasingly advisable to supplement the stamp mill with this apparatus for fine grinding; therefore, since 1910 it has been the current practice to provide one tube mill for each twenty stamps of 2,000-lb. falling weight, the aim being to obtain a final product of which 60 per cent is suited for treatment as sand, by cyanidation in vats, and 40 per cent as slime, the cyanide solution being forced through the pulp in filter presses. This development has progressed so far that in these latest two mills, the Springs and West Springs, the stamp mill is discarded entirely, and with it the old process of amalgamation.

Crushing by gyratory breakers is followed by tube milling, with the use of large pieces of ore as the grinding medium, the reject then being cracked to pieces of

half an inch. Special pebbles, imported from afar, are used no longer as grinders in the tube mill, it having been found more advantageous to use irregular pieces of the blanket ore itself, six or seven inches in diameter, as picked off the sorting belts. About sixteen tons of such material is used per tube mill per twenty-four hours. The liners are of the Osborn bar type. In the West Springs mill the tube mills have been enlarged to 20 ft. by 6½ ft. Each mill grinds 147 tons per twenty-four hours. The efficiency of the process is indicated by the fact that the content of the final residue has decreased from 0.62 dwt. at the original plant, in which amalgamation was used, to 0.44 dwt. of gold per ton at the new plant of the Springs mine. The cost of the West Springs mill is \$34 per ton milled per month when treating 40,000 tons during that period. I noticed with pleasure that two of my Californian friends, Charles Butters and Charles W. Merrill, are represented by inventions in use in this up-to-date mill, the former by his vacuum filter and the latter by his precipitation method in combination with the Crowe vacuum process. "Charlie Butters" is still well remembered at Johannesburg as a versatile and flamboyant exponent of the metallurgic art.

The West Springs property consists of 400 claims, each of three-quarters of an acre; the rope haulage underground uses 35,000 ft. of cable, which is employed in the same way as in the Brakpan. The tonnage hoisted per month is 57,000, of which 4,000 tons is waste. The remainder goes to the mill, where 20 per cent is removed by sorting on belts, this work being done by the natives, whose eyesight, apparently, is better than that of white men. In their skill as sorters they resemble the Mexicans. Mr. Bushell told me that 33 oz. of osmiridium is saved in a year, equivalent to £25 per month. It is found in the concentrate from the tube mill when the machine is cleaned previous to relining. At the Modderfontein B mill 50 oz. of this rare metal is collected each month on the blanket strakes, and when cleaning up the mortar boxes and tube mills. This reminds me that even diamonds are recovered from the blanket on the Rand. The stones are small because they are shattered by the mills, but the fact that they exist in the ore, as an alluvial product in the



General view looking south from New Modderfontein, No. 12 shaft

conglomerate, is worthy of note. In 1923 a six-carat stone was found in one of the mortar boxes of the Brakpan mill; it was worth £75.

At the City Deep we went into the drill shop and watched the natives in the act of sharpening the steel. This work has been done by them since 1922. Before that the sharpening was performed by whites at 22½s. per shift; now it is done by blacks at 3½ to 5s. per

and air are fed simultaneously through a hollow jumper to the bottom of the hole. When properly used this machine produces less than 200 particles of dust per cubic centimetre of air. A device for further reducing the proportion of dust, 87 per cent of which is silica, is Swift's water-feed attachment, an Australian invention.¹ Another extremely useful invention serves to sample the air at any working face. This is done by means of



The Modderfontein Deep

shift. This is a sign of the tendency to use native labor increasingly. The operation is purely mechanical, everything being set to gage. Two white men were bossing twenty-two Kafirs. The tempering and welding is done by whites. Attention to these matters has added greatly to the efficiency of drilling in the mines of the Rand.

The West Springs mine has forty tons of drill steel in circulation; it is tempered in a bath of potassium chloride heated to 800 deg. C., or just below the point of volatilization. The welding is done electrically, while keeping the hole open by means of a jet of compressed air; for all the steel is hollow to permit the passage of water, while drilling, and thereby to mitigate the dust. The particles of quartz that are the cause of phthisis, or silicosis, are from one to six microns in size, a micron being a thousandth part of a milligram—in other words, an impalpable powder. Investigation has shown that the largest particles of dust in the lungs of those killed by phthisis is only twelve microns. The dust used to be deadly at one time; if a man went into a raise, twenty years ago, to sample the ore, he came away as white as a miller in consequence of the dust that collected on his perspiring face. The general average of dust in the mines is 5.4 mg. per cubic metre of air; but in 1910 as much as 1,500 mg. was found in the air of a drift in the East Rand Proprietary mine. At that time the average life of a machine driller was less than seven years. Everybody who went underground suffered in the lungs, on account of the sharp particles of quartz, which deadened the tissue, so that the Rand was avoided by miners as a district in which not even high wages could compensate for the inevitable shortening of life. The first preventive was the use of water in the form of spray; then came the Leyner drill, in which water

the konimeter, invented by Sir Robert Kotzé, who, as Government Mining Engineer, was chairman of the Phthisis Prevention Committee, which has done splendid work in behalf of the miners of the Rand. The konimeter sucks the dusty air and allows it "to impinge at a high velocity through a narrow nozzle against a glass plate coated with an adhesive substance. . . . The glass plate is then placed under a microscope and the particles are counted and otherwise examined." I quote from the committee's report. Vaseline was used as the adhesive substance; but it has been found to be unnecessary, because the moist air when impinging on clean glass will cause the dust to be deposited upon its surface. Another useful device for sampling the air underground, to determine its dust content, is the sugar tube, a gravimetric method. The air is drawn into the tube by a pump; subsequently, the sugar, which holds the dust, is dissolved in water, and the coarse particles of dust are separated by screening. Particles larger than six microns are not considered injurious; the smaller ones render the lungs callous, or fibrotic.

The use of respirators is not well regarded by the committee, because a tight fit to the face is impracticable, and it is extremely difficult to get the underground workers to wear them. It is better therefore to proceed on the principle of diminishing the dust to an innocuous proportion. The one man, however, who ought to use a respirator in his work is the sampler. The use of water to allay the dust has the unfortunate result of saturating the air with moisture. At a temperature of 75 deg. F. such saturation seems to have no marked physiological effects, but as the temperature increases, say, to 80 deg., as it does in the deepest mines,

¹"Final Report of the Miners Phthisis Prevention Committee," 1919; p. 32.

it becomes difficult to labor strenuously. The death rate increases from 15 per thousand in mines having a temperature of 70 deg. to 20 per thousand in those having a temperature of 80 degrees.

Every applicant for work at the mines has to undergo a physical examination, by government officials, more particularly as to his lungs; and if there is the slightest disposition to weakness in that organ he is rejected. At intervals of six months each man who works as much as a hundred hours underground has to submit to examination by means of an X-ray photograph of his lungs. If he shows the first signs of dust, he is warned; he has the option to cease work and receive compensation at the rate of £300 per annum. If the silicosis is well defined, he is warned accordingly, and can take £700 in compensation; but he is not compelled to stop work until the tuberculosis develops, when the law forbids him to go underground, because his disease has become contagious. He then receives a pension of \$12 to \$20 per month, according to the size of his family, if any. If after the first warning he elects to remain at work, he still will get only the compensation originally due to him, this being an inducement for him to quit. The large sums of money required for compensations and pensions are, of course, a serious tax on the mining companies. The Crown Mines, for example, pays \$75,000 annually for this beneficent purpose. An aggregate of \$35,000,000 has been paid already in compensation to those afflicted with phthisis, and the liability of the mining companies in respect of awards under the Phthisis Act has now reached the enormous figure of \$45,000,000.

On our way back to the town we stopped to visit the Brakpan compound, in which the natives are housed and fed. We saw them drawn up in line about to receive their food for the evening meal. The various tribes were roughly segregated; one file consisted of Basutos, another of "boys" from the Portuguese territory, and another of Xosas from the East Cape district. Each man received a basin filled with corn porridge. The customary allowance of food to each native daily is 24 oz. of this mealie, together with 6 oz. of bread, 3 oz. of beans and peas, half a pound of meat, an ounce of sugar, 5 oz. of vegetables, and 2 oz. of peanuts. They were as much interested in us as we were in them; they stared, the whites of their eyes showing clear against the dark background. Most of them were wrapped around the hips in petticoat fashion. This is known

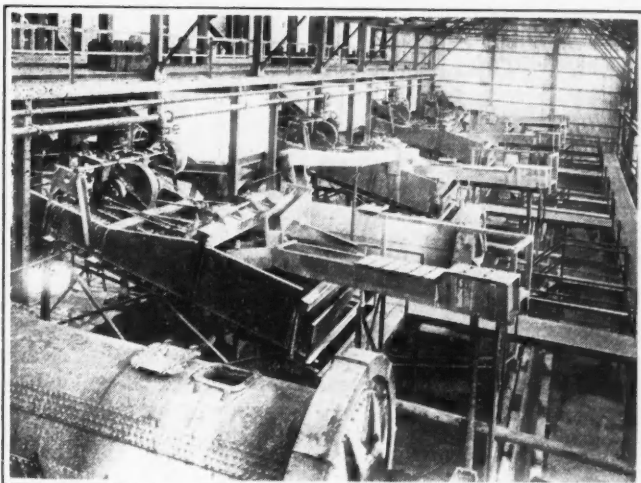


Native drilling an upper hole

as the *mtsjek*. Half of them wore a nether garment of some kind; and sometimes a singlet as well. An unlimited supply of mealie fermented with flour in the form of gruel is delivered through a faucet into their pannikins and tin cans. This compound contained 4,300 natives. They sleep on cubicles made of concrete, surfaced with magnesite cement, which can be washed easily. Many times in my travels through South Africa I noticed how readily the native can sleep on a surface of a hardness such as would render rest impossible to most of us. They are keenly observant of the white man's traits, and name him accordingly; one of our friends was named "eyes that laugh"; a thousand miles north the natives gave him the same sobriquet, "laughing eyes," using the two Swaheli words for "eyes" and "laughter." Another, who took big strides, was named "the ostrich man" in one locality, and in another "the great walk."

The Cape "boys" are the least attractive, because they come of a mixed breed. The finest are the Zulus, who are the pride of the Bantu race, the dominant negroid stock among the indigenous peoples of South Africa. A nude young Zulu is like a bronze statue. They were the great fighters of the last century, and gave much trouble to the original European settlers, Dutch and British alike.

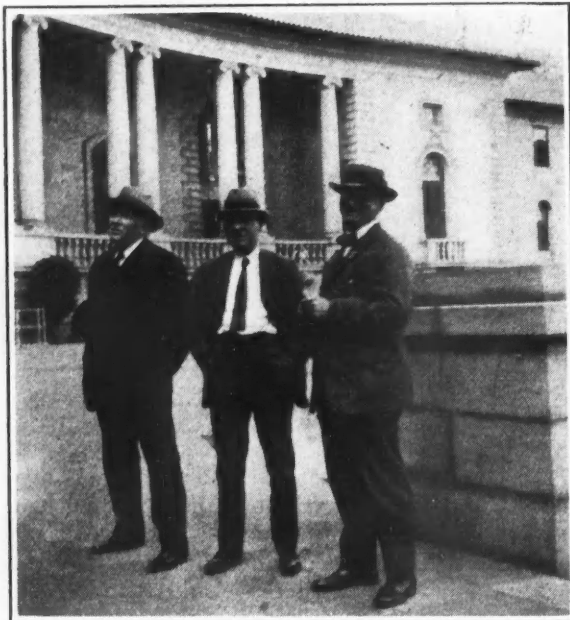
When leaving, I turned to look at the compound, and saw how things in themselves essentially unlovely can be beautified by the imagination. The inclosure of white-washed bungalows, with their red roofs, was overlooked by a big white dump, like a snowy mountain, tipped with pink as in a sunset by the earth that had been thrown upon it to prevent the wind from scattering it. Speaking of the dumps on the Rand, one is impressed by their size. That of the Crown Mines consists of 20,000,000 tons. They are white as snow when seen in the sunlight; and pains have to be taken to prevent the wind from blowing them abroad; indeed, if so many trees had not been planted all over the Rand the dust nuisance would be extreme. The planting of trees is done systematically and on a large scale, not only for this reason but also to provide timber for use



Interior of West Springs mill

underground. The Brakpan company plants 500,000 trees per annum, and these when they mature, within ten to fifteen years, are worth \$5 apiece. It is good business, or, shall I say? it combines the aesthetic with the commercial. The big dumps also suggest the vast voids that they represent underground, and the reason for the earth tremors. What a mole is the miner!

We were taken to the roof of the Corner House, the office building of the Central Mining & Investment Corporation, formerly identified with Wernher, Beit & Co.; there we had a panoramic view of the great gold field. The divide, or Witwatersrand, now shortened to Rand, means White Waters Range; it lies north of the town;



James S. Douglas, George Kingdon, and E. L. Bateman standing in front of the Union Building at Pretoria

forty years ago the Boers pastured their flocks on these wind-swept highlands, and when they found clear, or white, water, they named the place accordingly. I had the pleasure of a game of golf with Mr. Fred Wartenweiler at the Country Club, along this height of land, as the Canadians would call it, and I confess that it was a pleasure to see the trajectory of the little white ball against the background of industrial smoke in a locality that not so long ago was a mere wilderness.

The chief social center of the mining fraternity in Johannesburg is the Rand Club, which, incidentally, was the residence of the Prince of Wales during his recent visit to the mines. This club has been the scene of many historic meetings, and even today at the close of the afternoon the bar is lined three deep by gentlemen much afflicted by the aridity of the high altitude, which is 5,735 ft. In the antechamber I saw the following notice: "No person who is the subject of a country with which Great Britain was at war at any time between August, 1914, and November, 1918, shall be eligible as a candidate for election to membership." Even temporary hospitality is denied to such individuals, for a further proviso states: "No person that falls within the scope of this rule shall be admitted to the club house as a guest." This seems to indicate that the bitterness evoked by the late unpleasantness still persists at Johannesburg. After all, the purpose of a club is to bring together those who are congenial.

We were at Johannesburg on Good Friday, and noted the fact that all work at the mines ceased, according to law. The same holds good for Christmas day. The Union of South Africa is a Christian country. Sundays are set aside for rest; even work in the mills is stopped, except such as have been built since 1921; these have to cease crushing, but the leaching operations may continue. No other general holidays are observed. The staffs have a half holiday every Saturday. Each white man employed underground after one year receives twelve days' holiday; after two years, he receives eighteen days; after three years, a month; and during this vacation he is paid a pound sterling a day. Those working at surface after two years get twelve days at full pay. Such concessions, I feel sure, must do a great deal to diminish the "turnover" on the Rand, and, with the Sunday rest, to render work attractive at the mines.

A few scattered items of information may be recorded here. Johannesburg owes its name to Johann Rissik, who surveyed the site in the days of the Transvaal republic, and named it in compliment to Kruger and Joubert, both of whom bore the name of Johannes, not to mention the surveyor himself. The climate is good, the mean temperature for nineteen years being 60 deg. F., with a mean maximum of 70 deg. and a mean minimum of 50 deg. The air is dry, the annual evaporation averaging 74.6 in. Johannesburg enjoys sunshine 74 per cent of its days.

The mines of the Rand support 250,000 whites and 1,000,000 natives. Of the revenue of the Union of South Africa, 40 per cent is traceable to the mines. Several mines are worked under lease from, and royalty to, the government; of these the most productive is the Government Mining Areas, which was started in 1910, with the understanding that £1,400,000 would be spent in development. The first gold was produced in 1914. In 1922 the revenue was £2,776,762, the working cost £1,345,789, and the government's share of profit £737,839. The royalty to the government is 52 per cent. The other companies have been paying 1½s. on the pound in dividends and another 7½ per cent on gross profits, less amortization. This has been changed now to a straight 15 per cent, on account of the difficulties of accounting.

It has been ascertained that a mining enterprise on the Rand, to be a successful investment, over a period of twenty years, must pay a dividend of at least 15 per cent on the capital consumed. This is in accord with experience elsewhere. The Dutch think that they are not getting enough out of the mining companies, having regard to the fact that the mines are a wasting asset, but they fail to appreciate the fact that the mines made the country, and that the interior market afforded by Johannesburg has been a principal factor in developing its agricultural resources.

The most productive gold mine on the Rand has been the Robinson, I believe; it was one of the first on the Rand to be exploited, and is now nearing its end. Up to the close of last year the Robinson had produced 11,615,175 tons of ore, from which £24,737,332, or about \$123,000,000, had been extracted. The profit, during thirty-seven years, has been £14,205,593, equivalent to nearly 60 per cent of the gross value of the output. In 1888, shortly after the mine was opened up, the output was 7,486 tons, yielding £91,098, of which £69,437 was profit. At first the ore averaged 3 oz. per ton; in the second year the average was 2 oz.; and then, for

the next five years, 1 oz. In late years the yield has averaged about a pound, or \$5, or 5 dwt. per ton. Mines usually become weak, economically, in their old age, as they become deeper.

Electric power is delivered to the mines at a cost of 0.44d., or about three-quarters of a cent, per kilowatt-hour. This power is transmitted from Vereeniging and Rosherville, less than 50 miles distant, where it is generated by the use of coal. The biggest stamp mill is that of the Randfontein company, which has 600 stamps.

The total extent of development underground in the mines of the Rand has reached a grand aggregate of more than 3,000 miles of workings. In mines so extensive and employing such large numbers of men it becomes important to expedite their passage to and from their places of work. In a mine 3,000 ft. deep and employing 4,000 natives, it is customary for them to start going underground at 4 a.m., and for two hours thereafter; they start to come to surface at 2 p.m. and are all out of the mine at 4 p.m. The white bosses go underground first, so as to be ready to set the natives to work. The white man's shift is eight hours, collar to collar; the native's shift is ten to twelve hours. At the time of our visit the mining companies had begun to pay wages in gold coin, which was being minted at Pretoria from bullion sent thither from the reduction plants on the Rand.

On Good Friday, Mr. Edward L. Bateman took us in his Lincoln car to Pretoria, which is 32 miles from Johannesburg. The mention of the name of the car prompts me to say that most of the automobiles in South Africa are of American manufacture, and they are chiefly those of Henry Ford. The road to the capital of the Transvaal is lined all the way with a double row of trees, mostly pine, acacia, and eucalyptus; it passes over a rolling country, and allows the traveler many views of a landscape that has been given a parklike character by the planting of groups of trees. The veldt wore an expansive smile. Near the highway we saw the homes of several phthisis men, the miners who have retired with a compensation in consequence of injury to their lungs; they live on small ranches upon which they cultivate corn and chickens.

Pretoria has become an attractive city, partly because it is now the administrative center of the Union. The town was identified with Paul Kruger, the former president of the Transvaal republic, a shrewd but ignorant man, who played his part against an encroaching industrial civilization with considerable skill and much luck, for his adversaries, the promoters and financiers of the mining companies, gave the game away by one supremely foolish move. I refer to the Jameson raid, a piece of filibustering for which there was no excuse, and which did incalculable harm to South Africa by stultifying all the efforts that were being made at that time—in 1895—to assuage the old antagonism between the Boers and the British in the Cape Colony.

We visited the handsome Union Building, the administrative headquarters, and entered the Premier's room, in which is to be seen Oom Paul's chair—the throne of the redoubtable *voortrekker*. This is decorated with the Boer motto, *Endraft Maakt Magt* ("Right Makes Might.") The stone of the building is South African, the metal work is English, the glass is Belgian, the teak doors are from India, and the tools with which it was constructed are American. Later

we saw Kruger's cottage, its porch ornamented queerly by two lions in white marble, the gift of Samuel Marks, and one of the signs of an effort to placate the Boer chief. Opposite his home is the church to which he used to go. The clock in the tower has no hands; it is said that a mining magnate gave a pair of golden hands for this church clock, and that when Kruger fled to Delagoa Bay, in 1900, shortly before the British army entered Pretoria, he took them away with him. The story may be only one of Benvenuto's many concoctions, but I can testify that the hands are missing!

Upon our return in the evening we saw something of the suburbs of Johannesburg, the residential portion, in which our engineer friends have their homes. These are on the ridge, the real Witwatersrand, overlooking the city of mines. The houses are set in lovely gardens, in which, as at Kimberley, one finds most of the flowers that grow in California, such as cosmos, salvia, canna, coryopsis, convolvulus, hibiscus, and bougainvillea. These homes, and the kind friends that are the essential part of them, will be our best memory of Johannesburg.*

*In my previous article I referred to the African-born men, of British and Dutch stock, that were taking their places as leaders of the mining industry. I instanced Messrs. F. M. Anderson and F. A. Unger; may I add the names of G. H. Beatty, A. A. Coaton, H. H. Hill, C. J. Meyer, A. P. Nellmapius, and Sir Robert Kotzé himself, easily the most distinguished mining engineer in South Africa. My friends at Johannesburg may be interested to learn that the bottom of the deepest oil well in California is 6,737 ft. vertically from the surface. This well is known as the Amestoy; it is at Athens, in the Kettle Hills district.

Types of Flotation Reagents

The reagents employed in flotation work are of two types, one being known as "flotation-controlling" agents, and the other as "flotation" agents, states the U. S. Bureau of Mines in Serial 2,700, just issued and obtainable for the asking.

"Flotation" agents are those substances, invariably of organic nature, that cover the mineral particles with a film that permits them to be caught by the bubbles injected into the pulp. Another property of such substances is to lower the surface tension of the water, thus permitting the formation of small bubbles and a froth.

Generally speaking, the controlling agents should be and are added to the pulp at some point in the mill prior to the addition of the oils. Sometimes chemicals, such as lime, are added to the ore as it is dumped into the mill feed bins, but as a rule the controlling agents are added to the fine-grinding ball mills. The oils, if they are heavy and difficult to incorporate, may be added with the controlling agents to the same grinding mill. This would not seem to be good practice, but it is often done. Again, in many plants the reagents are mixed with the ore pulp in separate agitators.

The time of reaction required for controlling agents to impart the desired change in surface properties to the respective minerals present depends upon the ore being treated and the controlling agent found suitable for its treatment. With most reagents and most products, a "conditioning" period of one to five minutes generally is sufficient. In the treatment of a collective float concentrate of two minerals, A and B, to be separated into A and B concentrates, where, say, A is to be floated and B is to be suppressed, a conditioning period of several minutes to a half hour may be needed.

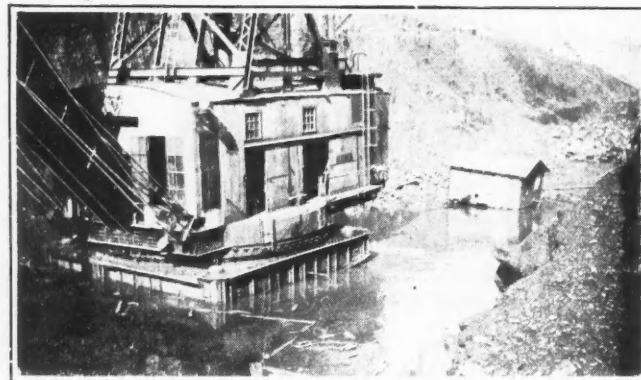
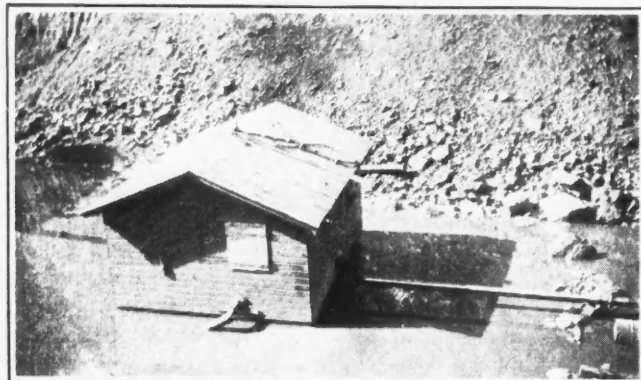
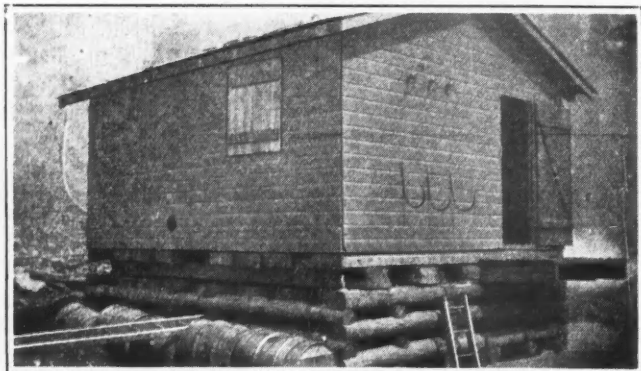
Where sodium or potassium xanthate is the reagent, it is fed direct into the first cell of the flotation machine, no conditioning period being required.

Useful Operating Ideas

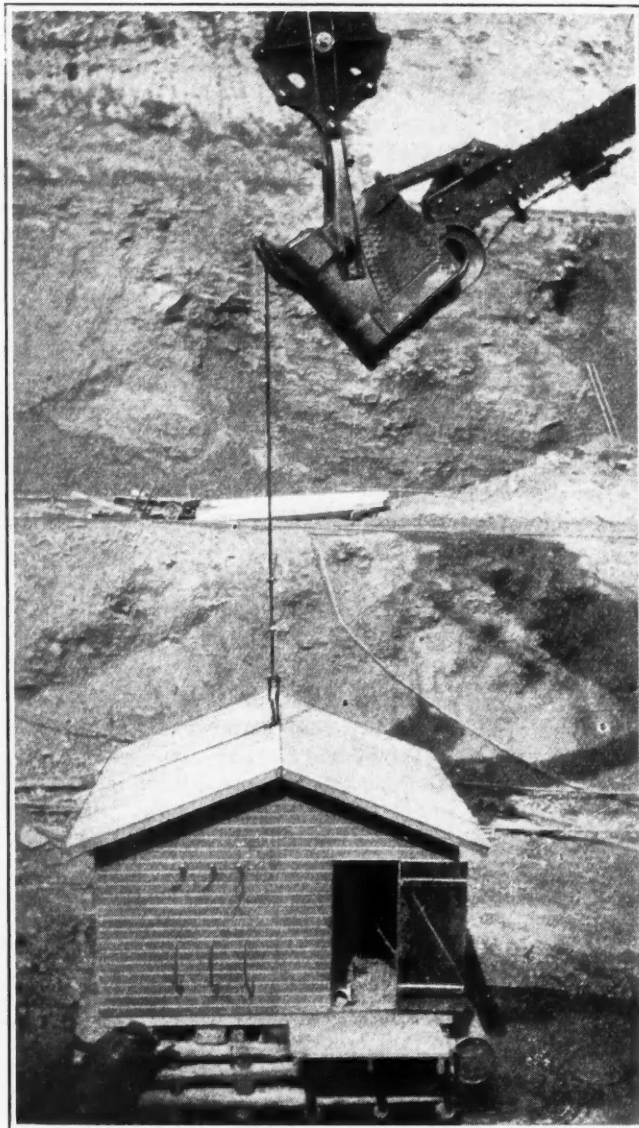
Barrel Scow for Open Pit Pumps

By L. C. Moore

An inexpensive equipment to keep an open pit free from water and to prevent any danger of submerging the pumping equipment was designed and put in service at the Boeing mine, Hibbing, Minn. Eight-inch poles, 16 ft. long, were used in the construction of a square crib, openings being left to fit 50-gal. empty steel oil barrels. Thirty-four barrels were placed in the cribbing and fourteen additional barrels were lashed to the sides with discarded $\frac{3}{4}$ -in. steel cable. Timbers 8x16 in. in section were bolted on top to support the pumps, and a



Top—Scow out of water, showing construction. Center—Pumping plant in operation. Bottom—General view of pit, showing scow floating behind 350-ton shovel



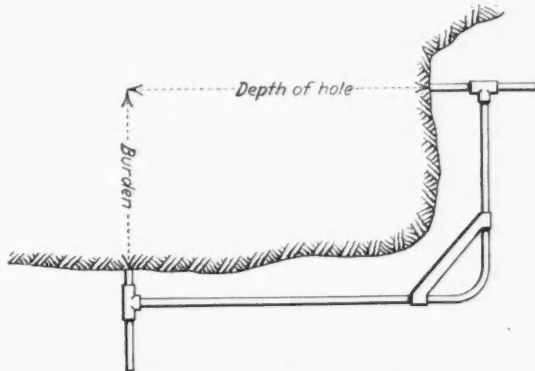
How the pumping plant is handled. Lifting is done with the 6-yd. dipper of the shovel

pump house, built in sections, was set on the top of the scow. Two 1,000-g.p.m. centrifugal pumps, 175-ft. and 350-ft. head respectively, were available and were placed on the scow. A 2,300-volt, three-conductor, steel-armored power cable connected the pump motors to the transmission line. As the pumps operated under a low head, 30 ft., a gate valve on the discharge line was necessary to prevent overloading the motors. The discharge line was provided with swing joints admitting of a variation of 12 ft. in the elevation of the scow. The complete outfit weighed 8 tons. The scow was built upon a flat car and was shifted by means of the 350-ton shovel used in the pit. Four $\frac{3}{4}$ -in. cables were attached to the corners and connected to a clevis at the center. A short wire rope sling was attached, the other end being looped over the bucket teeth. The equipment was tested out in August when a small cloudburst filled

the pit sufficiently to float the scow. The shovel wheel trucks were submerged but in seven hours time the water was out and the shovel at work. The outfit, as designed, can be readily dismantled, the equipment and sectional pump house can be used, and the oil barrels after cleaning and painting can be used again. The timber used in the construction had been discarded and was of little value.

Measuring Burden on Drill Holes

The direction of drill holes in stoping is usually left to the driller, who acquires by long experience skill in directing the course of the hole in such a way as to leave the prescribed burden upon it. Without this skill, inefficiency in the use of explosives results. Estimation by the eye of the burden on a given hole has therefore the disadvantage of uncertainty. G. Hildick Smith in the April number of the *Journal of the Chemical, Metallurgical and Mining Society of South Africa* describes an ingenious form of "hole director" for use in stoping. This consists of a length of pipe bent at a right angle, the short leg corresponding approximately to the depth of burden and the long end to the depth of hole. A tee is screwed on each end of the pipe, and round measuring rods are used in the longer portion of the tee at right angles to the pipe. By marking with chalk the approximate course of the drill hole on the exposed face of the



Device for measuring drill hole burden

rock the position of the collar of the hole and its direction are given by one of the rods as shown in the accompanying illustration. Smith states that tests made with the device showed that where it was used 81 per cent of the holes were drilled with the correct burden, but where the holes were spotted by individual judgment the burden ranged from 12 to 39 in. As a result of the use of the director, breaking costs have been reduced by as much as 20 per cent.

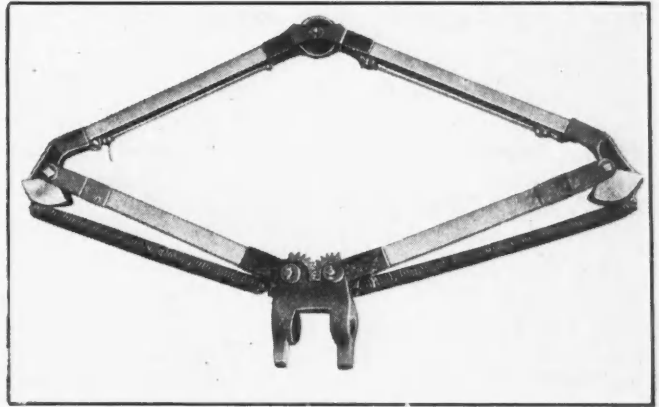
Making Stronger Concrete

Maximum strength in concrete is obtained by the selection of sand and gravel in proper size gradation, as less water is required to make the concrete workable and greater strength results. From experiments made by the Bureau of Standards, it is just as important to follow the foregoing principle in the case of the quick-hardening high-alumina cements as with portland cement. A gravel concrete made with the quick-hardening high-alumina cement develops as high a strength in 24 hours as a similarly proportioned portland cement would develop in 28 days. The use of quick-hardening high-alumina cement will avoid long delays.

Diamond Trolley for Mine Service

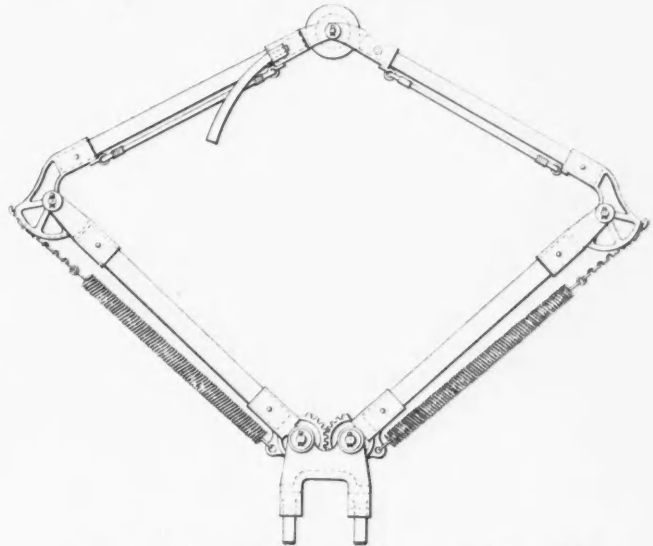
By A. A. Bawden

The accompanying illustration shows a type of diamond trolley used on the Gogebic Range. The open castings and inner hinge fork below the hinge pin are filled with babbitt to prevent fingers being caught as the trolley adjusts itself to the varying height of



Diamond trolley designed for underground service

the trolley wire. To prevent the frame from flying apart when one of the upper sticks is broken, a length of sash cord is extended along the under side of each stick and fastened to lugs brazed to the hinge forks. It is planned in the future to cast the lugs as a part of the hinge forks.



Construction of diamond trolley and guard

Name	BILL OF MATERIAL			Quantity
	Material	Remarks		
Base	Cast iron			1
Bottom geared yoke	Malleable iron			2
Bottom yoke pin	Cold-rolled steel			2
Cotter pin	Steel			4
Rivet	Steel	Plain		2
Tension spring	Steel	$\frac{3}{8}$ steel, 76 coils		2
Hickory sticks		$\frac{1}{2}$ x $1\frac{1}{2}$ x 22 in. long		2
Rivet	Steel	Plain		2
Square link chain	Malleable iron			2
Outer hinge fork	Malleable iron			2
Pin for hinge	Cold-rolled steel			2
Cotter pin	Steel			4
Rope hook	Malleable iron	Brazed on		4
Inner hinge fork	Malleable iron			2
Rivet	Steel	Plain		2
Hickory sticks		$\frac{1}{2}$ x $1\frac{1}{2}$ x 22 in. long		2
Rope	Hemp	20 in. long		2
Countersunk rivet	Steel	Plain		2
Outer fork	Bronze			1
Trolley wheel	Bronze			1
Fork pin	Cold-rolled steel			2
Cotter pin	Steel			2
Inner fork	Bronze			1
Lead-covered cable	Copper	Insulated		1

Discussion

Diminishing Values of Metals

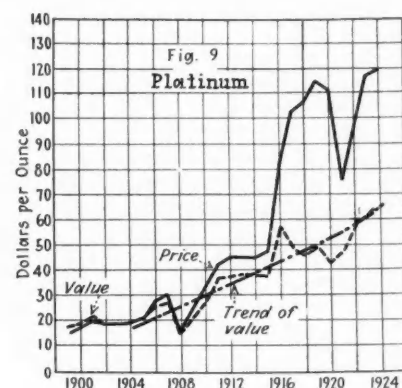
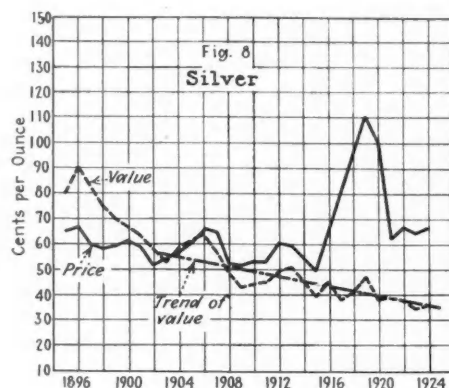
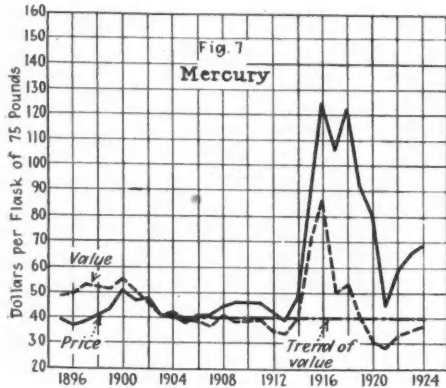
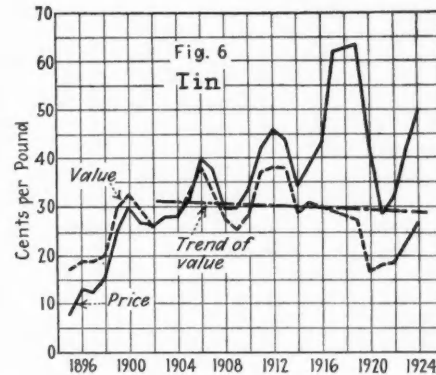
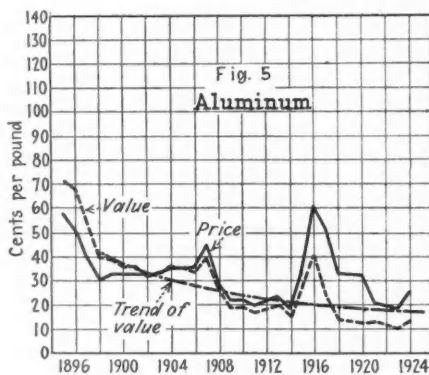
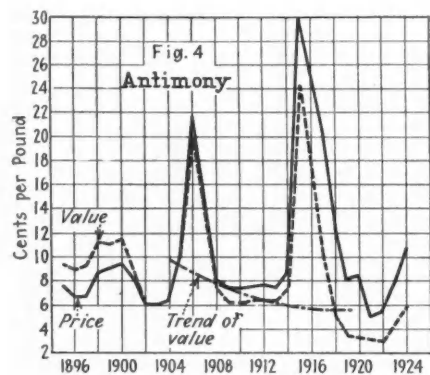
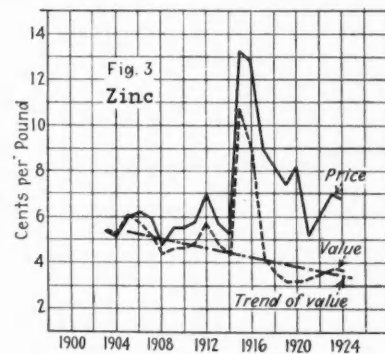
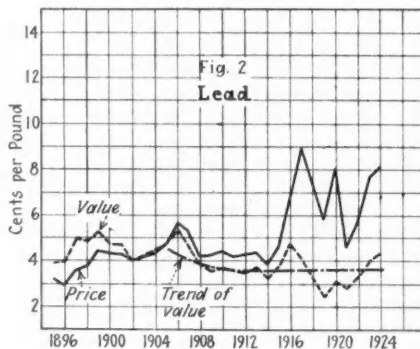
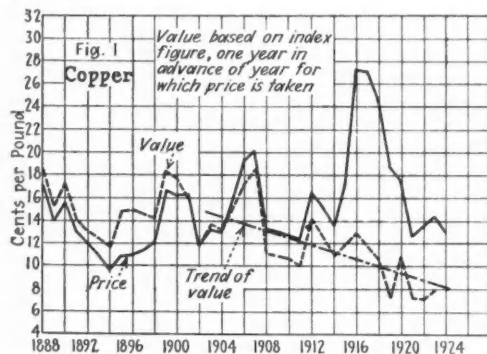
THE EDITOR:

Sir—Referring to the price and value of copper, as discussed in Mr. W. S. Black's interesting paper in *Mining Journal-Press* of May 16, I thought it would be interesting to extend this study to some of the other common and precious metals and make comparisons between them.

The application of Dun's index figures (given graphically in Mr. Black's article) to the price of each metal for a number of years is shown in the accompanying graphs. The value of each metal in terms of the 1903 dollar is obtained by dividing its average annual price by the index figure for the time during

which the metal is actually paid for. In the case of copper, which is usually sold for forward delivery, and in large blocks, the index figure for the year following that for which the price was averaged, as Mr. Black pointed out, would be most logical. For the other metals, which have diversified uses and are sold in smaller blocks, probably the use of the index figure for the year in question would not be very far wrong.

The metals considered besides copper are lead, zinc, antimony, aluminum, tin, mercury, silver, and platinum. The position of the trend of value curve will depend upon the year selected for the starting point. The trends of value for copper, lead, zinc, and antimony have been grouped in Fig. 10, and those for silver, mercury, tin, aluminum, and platinum have been



Average annual prices and values of nine metals

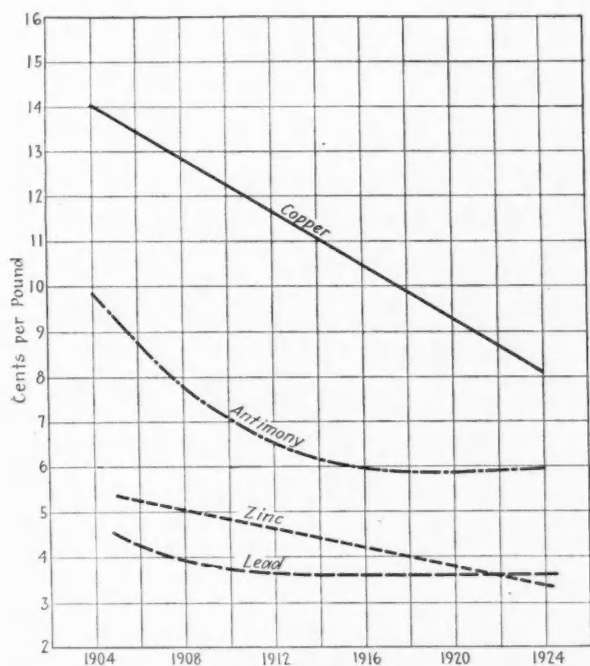


Fig. 10—Trend of values for copper, lead, zinc, and antimony

grouped in Fig. 11. This was done to have on one sheet the metals which do not vary too widely in money units per weight unit, so that the slope of the decreasing value curve for each metal could be compared. It will be observed in Fig. 10 that the copper curve has the greatest slope and is nearly uniform. Antimony has a similar slope to copper between 1905 and 1912, after which it becomes flattened, with a tendency to rise slightly. Zinc has a uniform slope but less than copper, and lead has the least slope of all the four metals. Similarly, in Fig. 11, silver has a rather steep slope which notes a fall in value from 54c. per ounce in 1905 to 36c. per ounce in 1924. The curve for the value of mercury is practically horizontal, showing the same value in 1924 as in 1905, in

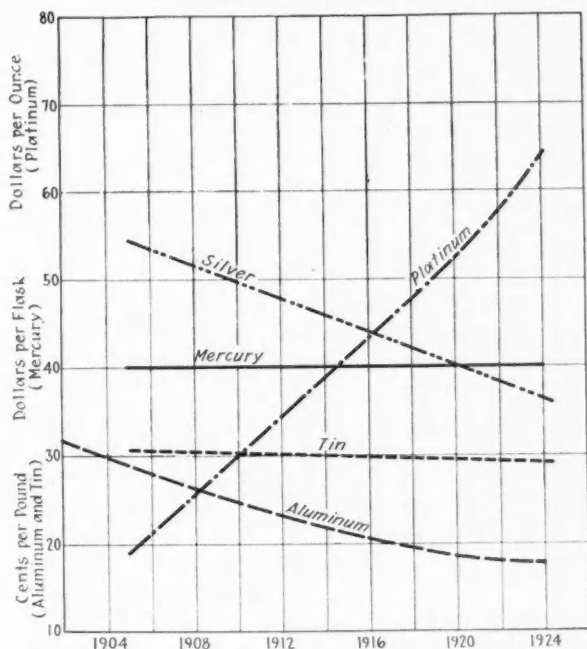


Fig. 11—Trend of values for aluminum, tin, mercury, silver, and platinum

terms of the 1903 dollar. Tin is almost equal to mercury in this regard, the recession in value amounting to about 2c. per pound. Aluminum has undergone a decided drop in value, but it has a recovering tendency, and in the last two and one-half years the value has been nearly constant. The platinum curve is presented in comparison to show the opposite tendency in value.

The quantitative recession in value of each metal requires a complete economic history of the metal for its proper interpretation, but the gradual reduction of the value of most metals is of interest and shows that copper does not stand alone.

War-time conditions had but little effect upon the value of half of the metals considered, in terms of the 1903 dollar. The metals most affected were zinc, antimony, aluminum, and mercury. These metals greatly increased in price and out of proportion to the stimulation of prices of other metals.

Rolla, Mo.

H. R. HANLEY.

Hydration of Anhydrite

THE EDITOR:

Sir—The editorial in the issue of *Mining Journal-Press* of Oct. 3, on the experimental conversion of anhydrite to gypsum, brings to public attention a point that has been more or less familiar to gypsum manufacturers and technologists for some time—that is, the unstable condition of finely divided anhydrite in presence of water. It is a matter that has been repeatedly tried out in laboratories and, I believe, has also been demonstrated on a larger scale by some of our commercial plants. Nevertheless, the efforts of the U. S. Bureau of Mines to determine the feasibility of hydrating the natural anhydrite on a practical basis are fully justified for the sake of general interest and because they may be of more extensive scope than any investigations hitherto made.

The point which the editorial makes, that complete hydration is not essential to the commercial operation inasmuch as use is made of gypsum with only 65 per cent hydrated sulphate, calls for some remark. There is more to be said of this deduction than appears at first blush. The impurities in gypsum rock have great influence upon the hardening properties of the calcined plaster. Some accelerate, some retard, and some little affect the formation of gypsum crystals, which constitutes the setting process of the calcined material—that is, the half-hydrate. It happens, however, that anhydrite falls in the class of obnoxious impurities, and even a slight admixture of this parent substance of nearly all gypsum rock upsets the normal course of setting of the ordinary types of plasters. Therefore, unless some easy and cheap method is found to overcome this peculiarity of admixed anhydrite, partly hydrated gypsum can be put to little use. As a matter of fact, nearly every gypsum mine has supplies of such mixed material which it would be glad to dispose of. Therein lies the problem nearest at hand. In the Eastern gypsum districts there is an abundance of such partly hydrated rock underlying the gypsum zone, which usually extends only a few hundred feet, 500 ft. at most, below the surface. The early exhaustion of the high-grade gypsum is probable for some deposits now actively exploited, notably those of western New York.

Albany, N. Y.

D. H. NEULAND.

Consultation

Treating Amalgamation Plant Scrap

A subscriber recently inquired for a practicable and economical method for recovering gold from scrap iron that accumulates around an amalgamating plant. No smelter was available and treatment at the mill was necessary. The query was published in our issue of Oct. 3, and already two replies have been received which we are publishing herewith. The first is from Charles Butters, successively of South Africa, Cobalt, Central America and elsewhere; the second from Tom R. Jones of the refinery of the Buffalo Mines, Ltd., at Cobalt. Mr. Jones' scheme perhaps does not fit the problem with which the first correspondent is faced, but it is nevertheless interesting. *Mining Journal-Press* appreciates the co-operation of these engineers.

In Johannesburg I bought everything in the shape of mill waste that carried gold. Wagon loads of old scrap, wooden screen frames, iron screens, worn shoes and dies and all kinds of scrap iron which had been in contact with amalgam—and in Johannesburg, in the early days, there was a lot of it.

First the wood was picked out and dried and burned. Next the iron was piled up on a clean swept portion of the floor laid on the arch of a reverberatory furnace which was 14 by 100 ft. To the iron was added a weighed amount of pyritic concentrate bought from the mills. The weight and value of the concentrate was carefully determined. To this was added from 2 to 5 per cent salt and 10 to 12 per cent water and the iron well bedded in this mixture. The heat from the furnace gradually set up a reaction and by keeping the bed damp the iron became corroded. Thin iron screens disappeared and thicker pieces of iron got a crust of oxide deeper than any adhering amalgam. At the end of about three weeks the pile of material was carefully cleaned up and put through a 5-ft. Krupp dry ball mill. From time to time the pieces of iron that had not succumbed would have to be removed from the ball mill. The resulting "concentrate" that passed out of the mill was weighed and assayed and bought and paid for after deducting the amount of gold contained in the added pyritic concentrates.

This product could be sampled and assayed with accuracy and after a seller had once inspected the clean iron resulting from the operation he was always satisfied he had a fair settlement upon the material.

We had the same experience with the accumulation of fine metallic iron, mercury, and amalgam, and adopted the following scheme for the recovery of the amalgam and silver: Pass the dried material through several moulders' screens from 4 to 12 mesh which should recover about 50 per cent of the mercury. Separate the metallic iron from mercury and amalgam by a short conveyor belt with a magnetic head pulley. Repeat until a satisfactory recovery is made.

If any sulphides of mercury are present digest in caustic soda solution with aluminum (metal scrap) to reduce the sulphides; then dry and continue. The installation and operation is inexpensive and the results are excellent.

Plating Base Metals With Chromium

"What success has been attained in the plating of base metals with chromium?"

The art of plating base metals with a protective coating of nickel, silver, copper, or zinc has been known and practiced for many years. In many cases these metals did not give satisfactory results, for it was inevitable that sooner or later tarnishing would destroy the appearance of the plated metal, and rust, or atmospheric corrosion, or the effects of chemicals, would break down the effectiveness of the protective covering. The ideal protective covering must produce a metallic coat which overcomes these two difficulties and resists wear.

Chromium plating satisfies these requirements. Chromium metal itself is bluish white in color. Its specific gravity when crystalline is 6.92 at 20 deg. In the table of metallic hardness prepared by the Smithsonian Institution, the diamond is assigned an arbitrary hardness of 10, and on this scale chromium is rated at 9. Because of this great hardness it can be drilled only with great care and difficulty and resists the wear and tarnish to which it may be subjected. In addition to this physical ruggedness, chromium is not affected by oxidation, moisture, by acids other than hydrochloric acid and hot sulphuric, nor by chemicals, and, therefore, it maintains its bright, white, platinum-like luster indefinitely.

Chromium may be deposited electrolytically in either a bright or a dull form, and when so deposited it takes a high polish of great brilliance. Because of the hardness and density of this metal, very thin coats are sufficient to assure long wear to the articles to which they are applied.

Chromium plating has been subjected to many tests, all of which indicate that the characteristics of the metal itself are maintained when electrolytically deposited. It is resistant to oxidation in the atmosphere, becoming coated with an oxide film only at very high temperatures. Alternate immersion tests of chromium-coated steel in tap water show no signs of rusting after many weeks. Though it is soluble in hydrochloric acid and in hot sulphuric acid, it is not affected in any way by boiling nitric acid. The action of ammonia, hydrogen sulphide fumes, and organic acids has shown no corrosion over considerable periods.

On properly prepared surfaces of iron, steel, copper, and nickel, electrolytic deposits of chromium have shown remarkable freedom from pin holes, pits, and similar defects when examined under the microscope, and in this feature chromium plating maintains its advantage over other electrolytic deposits. Like zinc, chromium is electro-positive to iron, and the rust-resistant qualities of iron so protected are thereby increased.

Chromium plating has been developed commercially by the Metal & Thermit Corporation, and has created a new place for itself as a protective coating in the industrial field.

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

METAL PRODUCTION of Mexico shows an increase over 1924. Domestic capital goes into mining industry. Few mining titles issued to Americans.

Columbia Steel Company acquires fifty-one iron-ore claims at Iron Mountain, Utah. Extension of Union Pacific to property in prospect.

Michigan Copper Mines nearly normal as regards labor. Mohawk yields 24 lb. copper per ton of rock.

Mount Morgan Mines closed indefinitely. Strikers draw fire from boilers and allow mines to fill.

Opportunity for U. S. Bureau of Mines to be a service agency for the industry.

Arizona Commercial Co. files \$6,000,000 damage suit against International Smelting Co.

Engineering Foundation and Bureau of Standards testing dams for hydro-electric power plants.

Bingham Mines, Utah, acquires 277 acres of mineral land adjoining present holdings.

Durango and Sinaloa mines dependent upon hydro-electric power. Mazapil copper expands operation.

Western Chemical Company doubles capacity of salt cake plant at Camp Verde.

Inspector Campbell, of Idaho, asks early hearing in \$100,000 damage suit.

Tri-State Mining Co. to build 350-ton mill near Cardin, Okla.

Concentration plant for zinc-lead ore to be erected near Hachita, N. M.

Santa Catalina Island Co. Ships 500 Tons Zinc Ore

Catalina Island, Calif., famed as a summer health resort, recently took on a new significance as an extensive producer of zinc, lead and silver, with the docking at the Parr Terminal, Oakland, of the freighter *S. S. Cabrillo* with 500 tons of zinc, lead and silver, manifested from Catalina for the Selby smelter.

Lead and silver ore mining has been done on a limited scale in the past, but the arrival of 500 tons of ore at the smelter foretells a new and probably extensive mining activity on the island.

Local agents for William Wrigley, chewing gum magnate, baseball promoter and sportsman, and the Selby Smelting Co., are predicting that the Catalina mining project will be worked on a large scale, in the near future, and that shipments such as that just received on the *Cabrillo* may be expected regularly.

The development of this property into a real mining camp will greatly change the personnel of this famous resort.

The diggings from which the ore comes are known as the Blackjack, and are approximately ten miles from Avalon, 1,600 ft. up a precipice, whence a three-mile road has been built to White's Landing.

The island was originally the property of the Covarrubias family, which owned it under a Spanish grant. The silver-lead deposit was known as early as 1863, but comparatively little work was done on the property. From the Spanish owners, the property passed to the Lick estate, thence to a British syndicate, and finally to the Banning interests, who held possession until 1919,

Reduction in Valuation Denied Comstock Merger

THE Comstock Merger Mines, Inc., operating on the Comstock Lode at Virginia City, Nev., shipped 37,700 tons of ore during August. The Gold Hill section produced 26,232 tons, and the Virginia City section produced 11,468 tons. Gross value was about \$181,147, or an average of about \$5 per ton for the month.

The Comstock Merger made application to the state board of equalization for a reduction in assessed valuation of its mill on American Flat from \$1,010,000 to \$750,000, and also on other property at Virginia City and Gold Hill. The mining committee of the state board rejected the petition for reduction in tax valuation on the mill, but allowed reductions on certain mine and surface improvements.

when title passed to the present owner, Wrigley. Thirty men are now at work.

The quarries on Catalina Island are supplying rock for paving purposes for the City of Long Beach, and investigating some minor complaint as to the character of the material supplied, the mine manager found upon assaying that the value of the material complained of was approximately \$40 per ton.

J. H. Patrick is president of the Wrigley Silver Co., D. M. Renton and John M. Steward are vice-presidents, and David P. Fleming is secretary. Approximately \$100,000 is to be spent on a concentration plant.

Inspector Campbell Asks Early Hearing

Early trial of the libel suit against Stewart Campbell, Idaho, state mining inspector, who is being sued by the Idaho Copper Corporation for \$100,000 for statements alleged to have damaged the business of the corporation, was urged in United States district court Tuesday morning by Jess Hawley, counsel for Mr. Campbell.

Discussing the statements alleged to have been made by Mr. Campbell that the stock of the corporation was worthless, counsel declared that it was the duty and privilege of the state mining inspector to make such statements for the protection of the invisible public.

The defense that Mr. Campbell was privileged as a state officer was declared by the plaintiff's counsel to be unsupported. It was declared that there was no privilege when the duty or authority was overstepped, which the plaintiff holds was done in this case. Except such duties as could be classified as those of a safety engineer in mine operation, the mine inspector has, according to plaintiff's counsel, only such other duties as would come under the blue sky law, which applies to all companies selling stocks in Idaho. The Idaho Copper Corporation, counsel averred, did not sell stock in Idaho, and, as alleged in the answer, was not operating the property in Idaho, therefore did not come within either provision of the blue sky law.

The charge raised by Mr. Campbell was that the corporation had not complied with the Idaho laws before offering stock for sale. The case has been pending for several weeks and its disposition is a test of the state law.

Plant for Concentration of Zinc Ore to Be Built Near Hachita, N. M.

The American Group Mines Co., Charles Fowles, manager, is preparing to construct a plant in the Hachita district of southwestern New Mexico, for the separation of zinc concentrate from the lead with which this metal is usually associated. The mill will be of 100 tons' daily capacity, equipped with a Marcy rod mill for fine grinding, Wilfley tables, and K. & K. flotation machines. The ore assays about 7 per cent each in lead and zinc, the former associated with silver.

Considerable experimental work has been done in Tucson by local metallurgists, who are keenly interested in the construction of the new plant. It is reported that experimentation has demonstrated that it is possible to produce two classes of concentrate, one carrying over 50 per cent lead, with 100 oz. of silver, and a second that carries about 50 per cent zinc and 15 oz. of silver.

The ore experimented with is said to be similar to that found in a mine at Parral, Mexico, where Mr. Fowles made extensive tests. In 1919, thirty carloads shipped from the New Mexican mine to El Paso are reported to have carried \$14,000 value in zinc, which not only was lost to the mine operators, but carried an additional penalty of \$4,500 for the 1,500 tons treated.

Tri-State Company to Build 350-Ton Mill

The Tri-State Mining Co. has let a contract for the erection of a modern plant of 350 tons' capacity on its lease northwest of Cardin, Okla. The plant will be completely modern and will have selective flotation equipment. Ben Hoskins is contractor. Work on the plant will begin at once.

This company has 80 acres of land, on which 170 drill holes have been made. There is one shaft 246 ft. deep, from which drifts have been started to develop two proven ore deposits. Other shafts will be sunk soon.

Greenback Mine, Leadville, Ships 160 Tons Daily

The Greenback Mine, Carbonate Hill, Leadville, Colo., employs over one hundred men and is producing daily about 160 tons of silver-lead ore, which is shipped to the smelter. Large quantities of lead-zinc-silver ores are being mined and put on a dump awaiting the erection of a plant that will successfully treat such complex ores. Electric pumps in the Greenback Mine keep the water below the 1,200 level, where a drift is being run to connect with the four-compartment shaft of the Pyrenee mine, belonging to the Deep Mines Co., which will be used to relieve the shaft on the Greenback mine. Another electric pump will soon be put in place that will handle the large flow of water in the several mines on Carbonate Hill and Iron Hill. Many other mines not owned by the Deep Mines Co. are receiving great benefit by the unwatering of the Greenback mine.

Contract Let for Rouyn Railway

A CONTRACT for the construction of the railway into Rouyn, Quebec, has been let to Foley Bros., of St. Paul, Minn. The railway will be built by the Rouyn Mines Railway and it is provided that the new line when completed will be leased to the Canadian Government Railways. The Quebec Government will guarantee an issue of \$5,000,000 thirty-year bonds, and has arranged a subsidy of \$50,000 a year for five years, effective from Feb. 1, 1928. Work must start by Nov. 1 and be completed by Dec. 1, 1926. Though work can be started within the time set, it is doubtful if the line can be completed by the end of next year.

Arizona Commercial Files Damage Suit Against International Smelting Co.

The apex litigation over the Arizona Commercial and Iron Cap properties, at Globe, Ariz., took a new turn recently when the Arizona Commercial Co. filed suit against the International Smelting Co., asking damages of \$6,000,000. The plaintiff alleges that approximately 400,000 tons of copper, and to some extent silver-bearing ore, shipped by the Iron Cap Copper Co., of Copper Hill, to the International smelter at Miami during the last few years, had been mined within the bounds of the Arizona Commercial Co.'s Defiance Lodge claim and that the shipments "comprise by far the largest part of all the ores which the Iron Cap company has delivered at any time to the smelter." It is charged that the smelting company has known that the plaintiff claimed title to the said ores.

Carson Patents Held Valid

On Oct. 12 the United States Supreme Court denied the petition of the American Smelting & Refining Co. for a writ of certiorari in the Carson patents on side-feeding reverberatory furnaces, thus sustaining the decision of the Circuit Court of Appeals for the ninth circuit, which held that the Carson patents were valid. The application of the Nevada Consolidated Copper Co. for leave as amicus curiae to file brief in support of petitions for writ of certiorari was also denied. The amount of damage for infringement has not been determined, but Carson's attorneys have filed suit against all copper companies using side-feeding reverberatory furnaces. Now that the Supreme Court has ruled on the case, it is expected that the suits will be expedited.

Ely-Pioche Makes First Shipment

The Ely-Pioche Amalgamated Mines Co., 50 miles south of Ely, Nev., has made its first shipment of ore. Eight men are employed. The company plans to work two shifts. Recent ore exposures assay from 488 to 552 oz. of silver to the ton and from 21 to 39 per cent lead.

Anglo-Canadian Exploration Developing Property in Manitoba

The report of the Anglo-Canadian Explorers for the year ended March 31, 1925, has been issued and shows expenditures of £41,719, of which £39,883 were spent in Canada. During the period 115 new properties were submitted and 39 of these were examined. In addition to examination work, the company has had prospecting parties of its own out, and a number of claims have been staked in central Manitoba, in Ontario, and in Quebec. The chief work has been done on the Oro-Grande property in central Manitoba, on which a shaft has been sunk 142 ft., and drifting started on the 125 level.

Since the end of the fiscal year the most important developments of the company have taken place. The Oro-Grande property has been closed and work has been concentrated on the WAD group of claims owned by the Central Manitoba Mines, Ltd. The Anglo Canadian company has taken over a substantial interest in the central Manitoba and has an option to purchase up to a one-half interest. A shaft has been completed to a depth of 400 ft. and the vein has just been intersected in the cross cut at 375 ft.

Engineers of both the WAD and the Anglo-Canadian Explorers believe these properties to be promising gold discoveries, and they feel convinced that they have a mine.

Bingham Mines Co. Acquires 277 Acres Adjoining Present Holdings

Control of the Montana-Bingham Consolidated Mining Co. owning the Tiewauke, the Eddie and the Fortuna groups and the Thrush claim, a total of 277 acres, has been secured from Honolulu interests by the Bingham Mines Co. A large part of the Montana-Bingham estate adjoins the Winamuck and the Dixon properties, recently acquired by the Bingham Mines Co. The Bingham Mines Co. now owns and controls in Bingham a total of 1,843 acres. It is proposed to carry on extensive development work in the Montana-Bingham property with a view of putting it on a productive basis as soon as possible.

Silver-Lead Ore Discovered at Cerro Gordo

At the old Cerro Gordo mine, east of Keeler, Inyo County, Calif., now under lease and purchase option by the Watterson Brothers, of Bishop, Calif., recent exploration has succeeded in discovering a new orebody from which several hundred tons of silver-lead ore has already been shipped. The orebody is now being developed. It is southwest of the old mine workings and in new ground.

Limestone to supply the Keeler plant of the Natural Soda Products Co. is being supplied by a quarry at Cerro Gordo. Both silver-lead ore and limestone are being transported by the wire-rope tramway between Keeler and Cerro Gordo.

Northern California Gold Dredging Improves

The Gleason area, on Clear Creek near Horsetown, Shasta County, Calif., has been acquired by Lawrence Gardella, who intends to construct a new dredge for working the area. Gardella is now operating a dredge on Clear Creek a short distance below the new area. At Trinity Center, Trinity County, the Estabrook Dredging Co. is reported to have struck rich ground in its operations on the Trinity River. The dredge has operated for a long time in gravel of low value, and the news of the recent strike will be welcomed by those interested in the welfare of the company.

Columbia Steel Acquires Iron Mines

The Columbia Steel Corporation of Utah and California has acquired the Milner-Dear-Lerch iron-ore holdings at Iron Mountain, Utah. The area taken over consists of 51 claims aggregating 921 acres, and is 7 miles south of Iron Springs, near Cedar City. The branch line of the Union Pacific extends to Iron Springs, and plans are in prospect for an extension to the new area as soon as mining operations begin and transportation becomes necessary. This recent move of the Columbia Steel increases the strength of the corporation in its resources of iron ore.

South Jackson Mine Sold for \$130,000

The South Jackson mine, near the Moore mine, at Jackson, Calif., has been acquired by the Moore Mining Co. The purchase option indicates a price of \$130,000, the first payment to be made on or before Jan. 1, 1928, and subsequent payments on Jan. 1, 1929; Jan. 1, 1930; Jan. 1, 1931, and Jan. 1, 1932. After Jan. 1, 1929, deferred payments are to bear interest at 6 per cent. On all ores mined from the South Jackson, the Moore Mining Co. is to pay 10 per cent royalty to the South Jackson, the various amounts to apply on the purchase price. The agreement provides that the Moore Mining Co. must be working on the 1,700 level of the South Jackson by Jan. 1, 1927. Operations on the South Jackson were discontinued some years ago, and the surface machinery was sold in 1918.

New Clay Plant at Lincoln, Calif.

The California Clay Corporation is completing the erection of a plant at Lincoln, Calif., where the corporation owns 100 acres of land containing deposits of clay. The clay will be mined by a power shovel and transported by gasoline locomotive and trains to a crusher building. It will be conveyed by belt conveyor to a storage shed of 18,000 tons capacity, and reclaimed by belt conveyors and prepared as needed for shipment. A spur track 1,700 ft. long has been constructed connecting with the main line of the Southern Pacific R.R. The plant will have a capacity of 600 tons per day.

Western Chemical Co. Doubles Capacity of Salt Cake Plant

Ancient Stone Hammers And Other Tools Found Embedded 65 Ft. Below Surface of Ground

On account of favorable market conditions Western Chemicals, Inc., is making additions to the plant at its sodium sulphate property at Camp Verde, Ariz., which will double the capacity. Production is at the rate of 200 tons per day. Salt cake, as the sodium sulphate is called after it has been purified in the treatment plant, is used principally in the manufacture of

Labor Situation at Michigan Copper Mines Improved

Labor conditions in the Michigan copper district have improved somewhat since the first half of the year. There has been a small net gain in the number of men employed, and, due to a smaller turnover, underground efficiency has improved. Unless the number of men coming into the district shows a marked increase, however, the opening of new shafts will not mean much either from the standpoint of labor or production. It will necessitate the transfer of men from one department to another. Some miners have

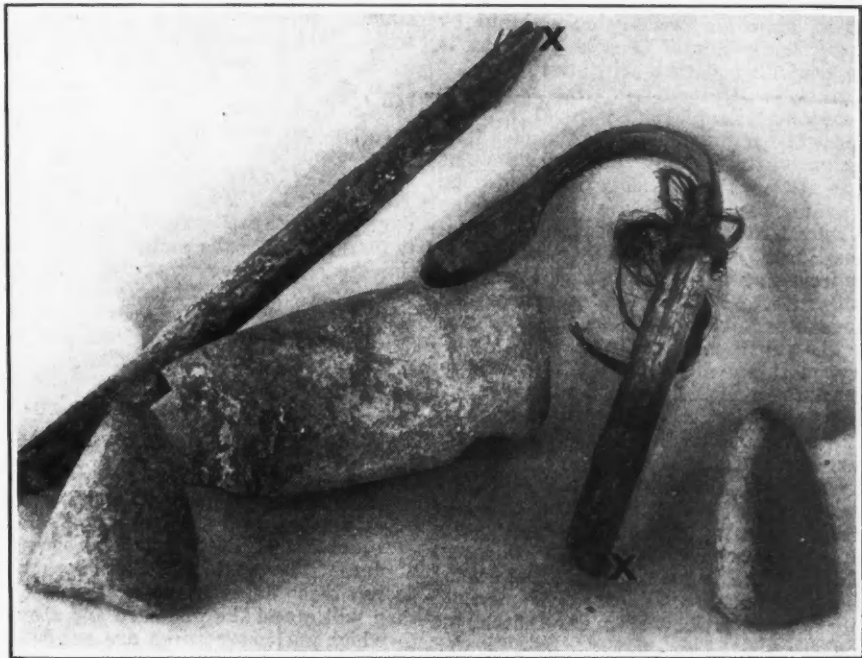


Photo by Minhinick
Stone hammer, with wooden handle, found in Camp Verde, Ariz., sulphate mine.
The points marked "X" indicate where handle was broken

paper. A southern paper manufacturing firm recently placed an order with the Camp Verde company for 10,800 tons of the product to be delivered during the course of a year. The order followed a series of tests, made on car-load shipments, which showed that the Camp Verde sodium sulphate is free from acid and is suitable for use in the manufacture of paper from southern pine. Experiments have been conducted at the property by chemists for baking-soda manufacturers and plans are being made for the construction of an auxiliary plant for the manufacture of this product. Common salt is made at the plant as a byproduct at the rate of two or three tons per day.

Recently several stone hammers were discovered, solidly embedded in the sodium sulphate ledge at a depth of 65 ft. below the surface. Crude wooden handles bent at the end to fit around the head of the hammer were found at the same time. Lashing resembling yucca fiber was found in place around one of the handles. Geological opinions are lacking as to whether the salt beds at Camp Verde are of marine or lacustrine origin so even an approximate guess at the age of the relics cannot be made. Diamond drilling is being done in hopes of finding potash deposits.

been coming in from regions in the iron districts where there has been reduction of forces. The restricted weekly working schedule continues at the Calumet & Hecla Consolidated properties, where night-shift miners and surface employees are working five shifts a week.

Mohawk Mine Yields 24 Lb. Copper per Ton of Rock

The Mohawk mine, in the Michigan copper district, is obtaining a high yield, averaging about 24 lb. of refined copper per ton, due principally to excellent copper rock in No. 6 shaft, which is supplying approximately 50 per cent of the output. No. 4 provides the bulk of the remaining tonnage, less than 10 per cent coming from No. 1, where the rock is lean.

An extensive program of development work is under way in Nos. 6 and 4, and mineralization in the new openings, particularly in No. 6, is the best in years. Better than 15 per cent of Mohawk's output is mass copper. Less than 3 per cent of the tonnage hoisted is waste rock. Mohawk is stamping on an average of 2,300 tons of rock daily, which is 300 tons under the capacity of the Mohawk mill.

Washington News

By Paul Wooton
Special Correspondent

Bureau of Mines a Service Agency of the Industry

Reorganization of the U. S. Bureau of Mines so as to make it essentially the service agency of the mining industry and a central clearing house of information on matters pertaining to mines and mining in the interest of the industry and the public can be used as an argument against compulsory fact-finding or regulatory legislation. Congress almost invariably does things by law. The policy of Secretary Hoover is in decided contrast with that way of dealing with industry. He has been outspoken in his disapproval of any form of compulsion or regulation. The extensive fact-finding activities that he has initiated in his department are on a voluntary basis. He has put the whole matter of the reorganization of the Bureau in the hands of a committee representative of the major mining activities, so that the reconstituted bureau may be of and for the industry.

The representative of the coal industry on this committee has been taking an active and a helpful part. His expressions in connection with the work of the committee, and the promise of former President Brydon, of the National Coal Association, to the Coal Commission, gives rise to the thought that the industry may be willing to make voluntary returns to the Bureau, which, in the belief of many, from now on is to be the out-and-out champion of those who go down in the earth in mines.

NO NEED FOR REGULATORY LAWS

Such action, it is contended, would meet the charge that the industry will not furnish the basic figures necessary to diagnose its ills. It would render unnecessary the proposal of the Oddie bill to withhold cars from those who refuse to make returns of basic facts, and would pave the way for the voluntary adoption of the many helpful provisions of that bill.

Both the Calder and the La Follette bills, designed to regulate the coal industry, provided for the collection of extensive statistical and economic data. This was pointed to as being in the interest of the industry itself, but these bills were by and for everyone except the coal industry. The milder Frelinghuysen bill, which followed, was characterized by the coal industry as an effort to treat the patient against his consent. Even the Oddie bill, which comes from a man of the mining industry, who simply has acted as compiler of suggestions made by various persons who are regarded as being authorities on coal, is considered by the coal operators as something handed down from above.

HOOVER'S SYMPATHY FOR THE INDUSTRY

Secretary Hoover apparently is in sympathy with the industry's attitude toward those bills. It is just as apparent that he does not agree with

most of the recommendations of the Coal Commission. He doubtless has been deterred from expressing it, so as to be guilty of no breach of etiquette toward a Presidential commission. Instead of putting the great weight of his influence behind such things as federal licensing, graded taxation, and control by the Interstate Commerce Commission, he has worked to encourage the industry itself to learn its own mind and settle its own difficulties. Secretary Hoover's experience with the Jacksonville wage agreement is thought to have increased his determination to go only so far as the industry desires. The contrast between doing things by legislation and doing things by and with the consent of the industry applies to the whole field of mining.

The search for a director of the Bureau of Mines, which really is a search for an Under Secretary of Mines, since the eventual creation of the latter office is believed to be assured, also has been turned over to the industry's committee. The desire in that connection is to induce some broad-gaged man of the industry to take the place. It is known that Secretary Hoover prefers this type of man to the civil servant or the academician, but the chance of success in such a quest is known, from previous experience, to be small.

Testing of Dams for Hydro- Electric Installations

Now that hydro-electric power is an essential factor in many industries, and especially in large mining operations, the question of the safety and security of dams is important. Engineers who design these dams, do so expecting that they will stand the pressure and storms to which such structures are subjected. Unless proper precautions are taken such disasters as the Johnstown flood may again happen. The engineer will require much data on these structures, and yet many essential data are not available. In order that this missing data may be recorded and available the Engineering Foundation and the Bureau of Standards are jointly conducting studies and investigations, including the testing of a full-sized experimental dam, on Stevenson Creek, near Fresno, California. Through the co-operation of Secretary Hoover and Director Burgess of the Bureau of Standards special instruments and methods to be used in testing the experimental dam have been devised and many helpful suggestions made by members of the Bureau staff in discussion with the Committee of methods for constructing the dam and conducting the tests.

The Coast and Geodetic Survey is also co-operating and has made available the experience, methods and equipment of the Survey in very exact measurements which will be useful in determining the deflections or bending of the dam under the pressure of water and other forces. These movements may be so small in some parts of the dam that the measurements will be in the order of hundredths or thousandths of an inch.

The instruments designed by the Bureau of Standards and those proposed

by the Coast and Geodetic Survey provide for just such refined measurements of small movements as are required in order to get from these tests sufficiently accurate information for engineering studies. Temperatures will be measured in the concrete of the dam from the time construction begins and many other tests will be made upon the concrete and the materials of which it is made. For measuring temperatures, both electrical resistance coils, or thermocouples, and thermometers, will be used. Altogether, thousands of measurements will be taken and minutely studied in order to get improved bases for the designing and building dams.

Excavation of the granite walls of the canyon for the foundation of the dam has been begun. It is now expected that the placing of the concrete and the setting of many of the instruments will be accomplished in December. This time has been carefully chosen by the Committee and its expert advisers in order to get the most favorable weather conditions when the temperature variations are the least and the temperature is at a minimum so that there will be the greatest probability of constructing the dam without the cracks which sometimes occur in concrete work done in warm weather. Since the dam is being built in a wild mountain canyon, some miles from the nearest village, a camp is being constructed nearby for the accommodation of the men who are building the dam and for the engineers and their assistants who will supervise its construction and carry on the tests. It is expected that about two years may be required to complete the full program.

Meanwhile, investigations of certain instruments and some of the properties of concrete have been begun at California Institute of Technology by Prof. R. R. Martel, through the courtesy of President Robert A. Millikan. At the University of California, in the engineering laboratories, extensive and very careful tests to determine many physical properties of concrete are progressing.

Anthracite Miners Fear Congressional Action

That which appears to be frantic efforts on the part of the United Mine Workers to bring about federal intervention leads some observers in Washington to think that everything will be done to force the administration to undertake to bring about a settlement before the convening of Congress. Apparently the mine workers sense the fact that regulation in some form is likely to result if Congress undertakes to compose the situation.

Organized labor is just as opposed to government regulation, many believe, as are the operators. William Green, when secretary of the Mine Workers, testified vigorously to that effect before the LaFollette sub-committee of the Senate Committee on Manufacture. Regulation probably would carry with it the fixing of wages by a federal board. This spectre probably is responsible for the signs President Lewis is showing that he is apprehensive of Congress.

Hollinger Installs New 10,000-Cu.Ft. Compressor

The average grade of ore going through the mill of the Hollinger Consolidated of the Porcupine gold field, of Northern Ontario, has increased over 10 per cent above that handled during the first half of the current year. A considerable quantity of ore from development was found to contain about \$14 per ton while average heads for more or less prolonged periods were found to average around \$10 per ton. The new 10,000-cu.ft. air compressor will provide power for at least 100 additional rock drills. Good progress is being made with the mill enlargement and the sinking of the Schumacher shaft.

Arcadian Consolidated Taps Amygdaloid Vein Carrying Copper

Arcadian Consolidated's exploratory work in an area not previously opened has aroused interest in mining circles in the Michigan copper district. The amygdaloid vein tapped by a crosscut from the 1,850-ft. or bottom level of New Arcadian shaft, at a distance of 450 ft. from the shaft, apparently is an important find, by reason of the copper contained. East of the shaft, from the 1,250-ft. level, a crosscut has tapped three amygdaloids containing some copper. There is interest in what the conglomerate formation will disclose, inasmuch as a previous opening of the lode from another point indicated promising values.

Mayflower-Old Colony's exploratory crosscut has penetrated the footwall of the St. Louis amygdaloid after passing through a long stretch of trap, and in another month will be well into the vein. There is considerable speculation whether the lode will be found commercially mineralized.

Lake Iron-Ore Shipments, Sept. 30, 20 Per Cent Larger Than Last Year

As the shipping season in the Lake Superior districts draws to a close, there is the usual rush to clean up stockpiles, thus augmenting shipments at the last minute. The Oliver Iron Mining Co. and some of the independents are increasing output from both open-pit and shaft mines. Efforts are being made by operators to clean up their stockpiles to escape Minnesota ore taxes next spring.

Shipments from docks to Sept. 30 were reported at 42,812,085 tons, against 34,961,635 tons in 1924 period. With two months remaining it is estimated that aggregate of the season's shipments will reach 52,000,000 to 53,000,000 tons.

The Duluth, Missabe & Northern docks at Duluth led for the season, with shipments of 14,294,847 tons against 10,891,165 tons last year. The Great Northern docks at Superior, handling independents' ore, loaded out 10,679,018 tons.

September ore shipments were reported at 7,354,873 tons against 6,164,931 tons a year before.

Comparative shipments for the

Crown Reserve Considering Two Plans for Refinancing

THE Crown Reserve Co., of Larder Lake, Ontario, is considering two plans for the further financing of its properties. One plan involves increasing the capital by another million shares of stock of \$1 par, which might be issued to shareholders at 15c. a share. This would provide sufficient money to determine whether or not the company has a profitable mine which would justify the further expenditures necessary to put it on a producing basis. Another proposal is to issue bonds, and while it is believed that these could be sold, it is pointed out that the issue of stock would give shareholders an opportunity to average down their holdings and if necessary a bond issue could then be made, which could be placed without difficulty.

Conditions at the property have shown some improvement, and the main vein is understood to be cut 1,200 ft. with a diamond drill. Values are reported to be comparatively low—about \$4.50; but development at this depth might show a better grade.

season to Oct. 1 were as follows:

	1925 Season to Oct. 1	1924 Season to Oct. 1
D. M. & N.	14,294,847	10,891,165
D. & I. R.	4,814,726	3,985,005
G. N.	10,679,018	10,295,246
N. P.	383,678	422,711
Soo-Superior	636,297	523,083
Soo-Ashland	1,333,412	961,676
C. N. W.-Ashland .	3,949,546	2,970,190
Escanaba:		
(C. & N. W.) . . .	2,737,811	2,090,747
(C. M. & St. P.) .	1,436,257	979,358
Marquette:		
(D. S. S. & A.) . .	933,551	755,213
(L. S. & I.) . . .	1,612,882	1,087,241
Totals	42,812,025	34,961,635

American Mining & Milling Co. to Resume Operations

The American Mining & Milling Co. of Boise, Idaho, after being idle for a number of years, plans to resume operations soon. Ore, of which there is 140,000 tons developed, contains gold, zinc, and lead. The property is 12 miles from Boise. It has a 100-ton mill and 2,700 ft. of development work, including a two-compartment shaft 225 ft. deep. All machinery is equipped for electric power, now available.

Osmiridium Discovered in Tasmania, Australia

Attention is being directed to recently discovered osmiridium fields at two different points in the western part of Tasmania, Australia. A few months ago a company was formed in Hobart to exploit the deposits, which give promise of becoming of importance. Late reports are to the effect that three prospectors who discovered the fields have taken into Hobart, as the result of two months' work, 33 oz. of osmiridium, which they sold for £1,008; and in one week, also, 70 oz. of the metal, worth £2,240, reached that city.

Castle-Trethewey Arranges for Additional Electric Power

The Castle-Trethewey, Gowganda, Northern Ontario, has arranged with the Northern Canada Power Co. for a supply of power. A transmission line will be run from a point near Elk Lake to the property 29 miles distant, the Castle-Trethewey bearing half the cost on which it will ultimately receive a liberal rebate. The power company undertakes to supply the mine with all the electricity required at current rates which is expected to be available early in January.

Quarter Interest in Bell Mine Sold to Harry Lee

Duncan McIntosh has sold a one-quarter interest in the Bell mine, near Beaverdell, to Harry Lee, who until Oct. 1 was in charge of the Federal Mining & Smelting Co.'s activities in the Boundary district of British Columbia. Mr. Lee resigned to join Mr. McIntosh in the operation of the Bell mine. The consideration has not been announced.

Zinc Deposit Discovered in Warren County, Va.

Assays of the newly discovered Bailey zinc-silver-gold mine, in Warren County, Va., 16 miles north of Luray, show metallic zinc, 38.20 per cent and metallic iron, 1.94 per cent, with small amounts of gold and silver. The farm on which the mine has been discovered is owned by J. Lee Bailey.

Work is being carried on about 10 ft. below the surface in a vein 25 ft. wide. The deposit is not far from the North and South branches of the Shenandoah River.

Oliver Company Surrenders Philbin Lease

Utica Mine to Be Stripped — Hill-Trumbull Mine Ships 500,000 Tons

The Philbin mine, at Hibbing, Minn., an underground operation of the Oliver Iron Mining Co., after running all season has been closed down. The stockpile has been shipped, and the lease surrendered to D. C. Rood, et al. This is a State of Minnesota fee mine from which the Oliver Company has shipped over 1,000,000 tons during the several years of its operation. The mine still contains over 1,700,000 tons of ore.

The contract for stripping at the Utica mine of Pickands, Mather & Co. at Hibbing has been let to A. Guthrie & Co. with headquarters at Calumet, Minn. The overburden on this orebody is approximately 150,000 yards, and, due to the uneven surface, trucks and small shovels will be used to remove it.

The Hill-Trumbull mine at Marble, Minn., of the Mesaba Cliffs Iron Mining Co., completed its season shipments on Oct. 6 with 400,000 tons of concentrates and 100,000 tons of shipping ore. The equipment is now being used to strip 150,000 tons of lean ore, after the completion of which it will be tied up for the rest of the year.

Metal Production of Mexico Shows Large Increase

Motor Trucks Supplant Burros as Means of Transporting Ore— Better Roads in Mountain Areas

Metal production of Mexico during the first three months of 1925 showed a large increase over that of the corresponding period of 1924, according to a government statement just issued. It was as follows: Gold, 12,028 kg.; silver, 1,383,400 kg.; lead, 87,334,788 kg.; copper, 20,736,691 kg., and zinc, 9,976,930 kg. During the month of August 202 titles to mines were issued. Of this number comparatively few were issued to Americans.

One of the notable features of the mining situation in Mexico at this time is the investment of domestic capital in the industry. Most of the American investments in mines are being made in the states of Sonora and Sinaloa, in proximity to the Southern Pacific of Mexico. The several districts in the states of Chihuahua and Durango show more activities in development operations than for several years. This fact is indicated by the large ore shipments to the smelters from those two states. Improved methods of transporting ores from the more remote camps also are noted. Motor trucks are being substituted for burros and mules wherever possible, and this modernization movement is causing the construction of better roads in the mountainous districts.

Marked Increase in Mineral Production of British Columbia

So marked has been the increase in the mineral production of, and the general interest taken in mining in, British Columbia, that the Provincial Department of Mines has issued a report, entitled "Summary of Mining Operations for the Eight Months Period from Jan. 1 to Aug. 31, 1925." It consists of 47 pages, and contains a general summary by John D. Galloway, provincial mineralogist, and a report by each of the six resident mining engineers of the activities in the respective districts.

The estimated production for the eight months period is:

Product	Quantities Produced, Jan. 1 to Aug. 31, 1925
Gold, oz.	148,000
Silver, oz.	5,280,000
Copper, lb.	44,570,000
Lead, lb.	142,000,000
Zinc, lb.	75,850,000
Coal, tons (2,240 lb.)	1,584,695
Coke, tons	48,980
Miscellaneous products ...	\$2,000,000

The value is placed at approximately \$41,000,000. As all signs point to this rate of production being maintained, it indicates that the value of the production for the full year will be more than \$60,000,000, which compares favorably with \$48,704,604 and \$41,304,320, the values of the mineral production of the province for the years 1924 and 1923, respectively.

The salient points brought out by Mr. Galloway in his summary are the reopening of the Copper Mountain mine by the Allenby Copper Corporation; the completion of additions and enlargements to the Trail smelter, whereby the capacity for the production of lead has

been raised to 350 tons per day and that of zinc to 200 tons per day; the completion of the 40,000 hp., hydro-electric plant by the West Kootenay Power & Light Co., which provides power for the Trail smelter and the Allenby Copper Corporation's mine and mill; and the construction of a new hydro-electric plant on the Elk River by the East Kootenay Power Co., which supplies power to the Sullivan and Stenwinder mines and to the Crow's Nest Pass Coal Co.'s collieries; the announcement by the Premier Gold Mining Company that the capacity of its mill and hydro-electric plant is to be doubled; the starting up of the old Rosebery mill by the Lucky Jim Lead & Zinc Co.; the construction of a 500-ton concentrator to treat the old dumps at the St. Eugene mine, at Moyie; new deep-level development at the White-water mine, at Retallack; and the successful operation of the Kafue Copper Development Co.'s dredge on Antler Creek, in the Cariboo district.

The important mining transactions have been the acquirement of the Fortynine group, at the head of the Salmon River valley, by the Premier Gold Mining Co.; the acquirement of a controlling interest in the Atlin Silver Lead Mines and the purchase of the Sally mine, at Beaverdell, by the Federal Mining & Smelting Co.; the option of the Kicking Horse and Monarch mines, in East Kootenay, by A. B. Trites and associates; and the sale of the Reno mine, near Sheep Creek.

Writing on mining promotion, Mr. Galloway says:

"It is inevitable in a movement of this nature that some worthless properties are acquired and promoted; also that the public is misled by some of the statements made in connection with the selling of stock. Such a condition is not peculiar to mining, but is the invariable accompaniment of speculation. The policy of the department is not in any way to hinder the development of any mineral property, but to make sure that the prospectus and descriptive literature issued by any public company about its mineral property do not misrepresent the actual facts."

Gold Ore Worth \$120,000 Shipped Through Ajo

Within a year, gold concentrates to the value of \$120,000 have been shipped through Ajo, Ariz., to the El Paso smelter, by the Sierra Pinta Mining Co., besides gold bullion, which has been sent to the San Francisco Mint direct. The mine is 83 miles south of Ajo, across the Mexican border, and is managed by Cyrus F. Weeks. Development work is being continued.

The Allison property, in the Baboquivari Mountains, between Tucson and Ajo, is preparing to install a 100-ton cyanide plant at the mine, and engineers employed are now on the ground investigating conditions.

It is expected that diamond drilling will start this month on the property of the Ajo-Arizona Copper Co., which has acquired a large acreage on the desert near Ajo, with croppings of copper. The work is to be done by the E. J. Longyear Co. of Minneapolis.

Melbourne Letter

By Peter G. Tait
Special Correspondent

Mount Morgan Mines Close Indefinitely, Due Largely to Labor Troubles

Wiluna Development Syndicate Proceeding on Well-Planned Program

Melbourne, Sept. 14.—The blow has fallen. Mount Morgan has closed down. At time of writing it is impossible to say what the future has in store. The cessation of operations was directly due to the general strike of the Queensland railways. After this strike was declared off, the Mount Morgan employees seized the opportunity to ask the management for a definite statement as to the future intentions of the company and forcibly compelled the staff to withdraw. The strikers went so far as to draw the fires from the boilers, thus preventing the mine from being kept free of water. In the meantime A. A. Boyd, general manager, was in communication with the directors, who were arranging for a conference with the Premier of Queensland. To add to the troubles of the company, a fire broke out in the main shaft on Sept. 12. It is understood that the fire is on the 750 level. There was a ready response on the part of the men to quell the outbreak, and the shaft has been sealed.

Cariboo Development, Ltd., has been formed in Sydney, N. S. W., with a nominal capital of £20,000, to carry on general mining operations in British Columbia and other countries. Several well-known mining men are associated with the venture.

H. E. Vail, manager of the Lake View and Star, and attorney for the Wiluna Development Syndicate, replying to a newspaper correspondent who asked whether Wiluna ore could be treated at a profit, states: "I have taken every precaution to protect the syndicate's interests by obtaining confirmation of my results, and have refrained from publishing anything which is not amply confirmed. I reported the lode was 42 ft. wide of an average value of 39s. 6d. per ton. This has been confirmed. I reported that preliminary tests proved the ore was amenable to treatment by roasting. I could not then make a more definite statement, but I am now in a position to state that further treatment tests prove that the ore is amenable to treatment by roasting, fine grinding, and cyaniding at a cost not greater than our treatment at Lake View and Star, and our tests indicate that we may expect a 90 per cent extraction. As mining can be done for much less at Wiluna than at Kalgoorlie, the syndicate is quite satisfied that ore values at 39s. 6d. per ton will return a very handsome profit. The ore from the crosscut contains no antimony whatever, and the government analyst has tested samples from the bores of both the east and west lodes, and finds no antimony therein.

I have invited the state mining engineer to visit the mines to examine and sample the lode and to make any investigation he desires. The syndicate realizes the importance of a thorough investigation of the property, and having exhausted the £20,000 originally subscribed increased its capital to £50,000. The original shareholders have taken up their full quota of the additional 20,000 shares issued, so that we are in a sound financial position. This will permit of such investigation as will enable the syndicate to obtain the large amount of capital necessary to equip the property with modern machinery for a monthly output of 40,000 to 50,000 tons. In conclusion, I wish to state that I have endeavored to avoid any tendency to boom. We are proceeding on sound business lines, and I hope our undertaking will prove a great success not only for those who so courageously subscribed to the venture but as a much needed help to the state generally."

Durango and Sinaloa Mines Dependent Upon Electric Power

Mine owners of the more remote districts of the States of Durango and Sinaloa are optimistic over the prospects of electric power development which will enable them to operate their properties at much lower cost than at present. It is stated that three large hydro-electric projects are now being promoted to supply power to mines and other industries. New machinery and equipment are being installed in the Bejan mines in the San Juan de Guadalupe district, recently purchased by the Mazapil Copper Co. Although these mines have produced large quantities of ore it is expected that the output will be greatly increased when the improvements now under way are completed. The Trinidad mines, in the Sierra Ramirez, owned by Luis Zuberia y Campa of Torreon, have been leased to Tobias E. Guzman. He has increased the working force. Ore shipments to the smelter at Torreon are much larger than before he examined the property. Guzman also has taken over a number of promising claims in the San Juan de Guadalupe district.

The Aguila de Acero mine, in the Sierra Ramirez, is producing rich ore, which is being shipped to the smelter at Torreon. The mine is owned by Francisco J. Lozano and associates. Development of the Ampliacion del Fenix mine, in the San Lorenzo Mountains, by Francisco Romo, will be started soon. New machinery and equipment will be installed. The Tres Rosas mine, in the Sierra Ramirez, is being equipped with new machinery, preparatory to enlarging development work. The property is owned by Juan Jimenez.

Canadian Nickel Exports Amount to \$10,000,000 per Year

The growing importance of the nickel industry in Canada is emphasized by recent export figures. During the fiscal year ending March, 1925, the total nickel and its products exported from Canada amounted to more than \$10,000,000, as against \$9,000,000 for 1924 and \$8,800,000 for 1923.

London Letter

By W. A. Dorman
Special Correspondent

Gaika Gold Mines to Be Consolidated With Globe and Phoenix

Shamva Mines Opens New Orebody— Increased Interest in Nigerian Tin

London, Sept. 29—During the ten months to April 30 last, the Gaika Gold Mining Co. (Rhodesia) crushed 50,294 tons of ore, of which 40,135 tons were treated in the ordinary plant and 10,159 tons in the refractory treatment plant. In the refractory slimes 9,734 tons are weathering, before being treated by cyanide. Experimental work, it is stated, leads to the belief that a satisfactory extraction will be obtained by cyanide when the slimes have weathered sufficiently. Weathering apparently takes a considerable time, as the high grade slime (8.767 dwt. per ton) only dried off sufficiently to commence weathering in April, and it is unlikely that it will be sufficiently weathered to permit of treatment during the current year. This refractory slime carried a high percentage of stibnite in addition to other sulphides. The directors state that since the close of the company's year prospects have improved in a direction that the board hopes may be sufficiently advanced for announcement at the meeting. The statement is somewhat cryptic, but apparently it means that a proposal will be brought forward for amalgamating the Gaika, Globe & Phoenix, and some claims owned by the Rhodesia Exploration.

The Shamva Mines (Rhodesia), a low-grade proposition, yielding scarcely 4 dwt. has announced an important strike, which in its case is high-grade ore. In the incline shaft the main body of ore has been intersected, assaying at this point 5½ dwt. and 15 ft. exposed assay 8 dwt. per ton. The ore, it is stated, still continues.

Frank B. Powell recently returned from a visit to the Nigerian tin fields, and has expressed himself in very hopeful vein. He is of opinion that shareholders who have waited so long for dividends will soon be rewarded. He states that the steam shovel plant installed at Keffi is doing excellent work, and he expects to see several other plants of the dragline and steam shovel class working on the field within the next two years. More mechanical appliances are being installed all over the field, and a general increase in the output can be looked for.

That increased interest is being taken in Nigerian tin is shown by the fact that Sir Abe Bailey, whose interests are mainly in South Africa and Rhodesia, has secured the control of the Ex-lands Nigeria, the Nigerian Base Metals Corporation, and the Anglo-Nigerian Tin Mines. As regards tin in Cornwall, J. A. Dennison, an engineer of the Anglo-French Exploration Co., is to join the board of the Geevor Tin Mines. Arthur Richards, M.I.M.M., was

recently appointed joint managing director of the Company. W. E. Thorne, M.I.M.M., formerly on the technical staff of the Consolidated Gold Fields, has gone to Central Africa to investigate the copper properties controlled by Edmund Davis.

The directors of Lena Goldfields (Siberia) announce that their engineers will take possession of the Lenskoie property in October. Apparently the plant has been kept at work on some scale, as they estimate that the production for the month will be at the rate of £2,000 daily.

It is reported that a lead vein carrying a small amount of silver has been discovered in the Launceston district of Cornwall. A shaft 40 ft. deep has been sunk, and it is said that the find is of importance.

German Company Secures Oil- Shale Concession in Esthonia

The Esthonian Government is reported to have recently granted a concession for the exploitation of 6,000 hectares of oil-shale land to a German company, the "Deutsche Continental Gesellschaft." The agreement stipulates that the company within the course of a year shall build a refinery on Esthonian territory to have a working capacity of fifty tons of oil shale per day.

Recent Developments in Mazapil District, Zacatecas, Mex.

The Nazareno mine of the Cia. Minera Nazareno y Catasillas, Concepcion del Oro, Zacatecas, is producing 1,200 tons of sulphide ore per month and is expected to increase this tonnage to 2,000 tons per month. The No. 2 shaft in the Alicotte mine belonging to the same company is to be sunk an additional 50 meters as soon as the power transmission line is completed. S. F. Shaw is general manager. The Providencia mine of the Cia. Minera de Peñoles has suspended production for a short time until repairs on the power plant are completed. E. A. Manderfield is superintendent. The Bonanza unit of the A. S. & R. Co. has taken a lease in the Rucio mine in the Mazapil district and is installing equipment for carrying out a development campaign. B. S. Staiger is superintendent.

The Mazapil Copper Co., Ltd., is installing a 100-ton concentration mill at Concepcion del Oro in the Mazapil district for treating the mixed sulphide ores from the San Eligio and other mines of this company. The San Marcos Co. is carrying on development and continuing to extract lead-silver ore. Rafael Valdez is superintendent.

Nipissing Installs Own Power Plant

The Nipissing has completed the installation of its own power plant on its property in the South Lorrain silver area of Northern Ontario. Power has been brought from the transmission line of the Northern Ontario Light and Power Co. and a new compressor has been installed.

Men You Should Know About

Charles A. Mitke is in California on professional business.

Rudolf Gahl, consulting metallurgist, has returned to his home in Berkeley, Calif., from a trip to Germany.

H. J. Evans is now superintendent of the Cia. Mra. Nazarino y Catasillas, in the Mazapil district of Zacatecas, Mexico.

Colonel John C. Greenway has re-established his residence at Ajo, Ariz., and has opened up offices in the Valley Bank Building.

S. F. Shaw is returning to San Antonio from an inspection of mines at Mazapil, Zacatecas, and Sierra Mojada, Coahuila, Mexico.

Carl Lund, of Tonopah, Nev., has taken over the direction of a group of copper-silver claims between Tucson and Florence, Ariz.

E. E. McCarthy, resident manager of the Yukon Gold Co. in the Malay States, was recently in San Francisco en route to New York.

H. C. Carlisle, in charge of western operations for the Tonopah Mining Co., of Nevada, was recently in Reno and vicinity from San Francisco.

T. A. Rickard, contributing editor of *Engineering and Mining Journal-Press*, is president of the California branch of the English Speaking Union of the United States.

B. F. Edwards, manager for the Brouher interests in California and Nevada, has returned to Oakland from a visit to Tonopah, Manhattan, and other Nevada points.

Claude Allen has been promoted to the position of superintendent of the Cabrestante group of mines belonging to the Mazapil Copper Co., Concepcion del Oro, Zacatecas, Mexico.

Charles W. Clark, son of the late Senator William A. Clark, and president of the United Verde Copper Co., was married in Paris recently to Mrs. Elizabeth Judge of San Francisco.

A. H. Hubbell, managing editor of *Mining Journal-Press*, is making a field trip through the iron-mining regions of Michigan and Minnesota. He will return to New York the first of next month.

Olaf P. Jenkins, formerly with the Arizona bureau of mines, has resigned his position as associate professor of economic geology at the State College of Washington to accept a position in the Dutch East Indies.

Professor Carle R. Hayward, of the metallurgical department, Massachusetts Institute of Technology, has been elected chairman of the Boston Section, American Institute of Mining and Metallurgical Engineers.

L. G. Trueheart, formerly connected with the Morenci branch of the Phelps Dodge Corporation, and now with the Ulen Corporation, is in Athens, Greece, on business for his company. Prior to his departure for Athens, Mr. Trueheart was located at La Paz, Bolivia.

R. M. Wellington, general manager of the Wellington Mines Co., Brecken-

ridge, Colo., was recently in Tonopah, Nev., where he investigated sources of custom ore for the Bethlehem company's mill, which under present plans is to be operated as a custom plant if sufficient ore can be derived from the contiguous districts.

Archer E. Wheeler has been retained by the Noranda Mines, Ltd., to investigate the ores of the Horne property, with a view to designing a smelter. Mr. Wheeler was formerly in charge of the Anaconda plant at Great Falls and has been consulting engineer for the Union Minière du Haut-Katanga.

Wilbur A. Nelson is now at the University of Virginia, Charlottesville, as Corcoran professor of geology, head of



Wilbur A. Nelson

the department of geology of the University of Virginia and director of the Virginia Geological Survey.

Wayne Darlington has just left New York, where he has been for a few days on business connected with the Kay Development Co., Mackay, Idaho. Mr. Darlington is president and manager of that company, which is developing a body of zinc-copper ore near Mackay.

Irving C. Harris, consulting hydro-electric engineer of Los Angeles, W. C. Chitty, electrical engineer for Minas Pedrazzini, and Morton Webber have been investigating the power problem of the Santiago y Anexas S. A., which owns a group of silver mines in Morelos, to which company Mr. Webber is consulting engineer.

George Dawe, smelter superintendent of the Calumet & Arizona Mining Co., has made the announcement that **H. L. Gooding** has been promoted to the position of master mechanic, to succeed **F. M. Stocker**, resigned. The new master mechanic has been with the C. & A. since 1907 and until his new appointment was chief electrician.

Harold O. Davidson, superintendent in charge of sinking the Geneva mine shaft for the Oliver Iron Mining Co., Ironwood, Mich., has resigned to accept a position as mining engineer with the Michigan Conservation Department, with headquarters at Lansing. He also

will assist Engineer Barrett, of the Michigan geological department, in the appraisal of iron, copper, and other mines in the state. He will enter upon his new duties in November.

William Baragwanath has held the position of Director of Geological Survey & Chief Mining Surveyor of Victoria, Australia, for the last five years, and was one of the representatives of that state at a conference of Australian geologists held in Melbourne last June. Born in 1878, Mr. Baragwanath was educated at Ballarat, one of the chief cities and oldest mining centers of Victoria, and there received his early training and practice in underground surveying. In 1898 and 1899 he obtained land surveyor's and mining surveyor's certificates, and in 1909 the diploma of geologist at the Ballarat School of Mines. He had charge of the Walhalla underground surveys for the Victorian Geological Survey, and carried out the Castlemaine surveys, on which gold field he wrote a Memoir (No. 3 of the Victorian Geological Survey publications); and completed surveys of the Baw and Mount Lookout regions, embracing an area of 300 square miles of the rough mountainous country of Gippsland. In 1907 he took charge of the Ballarat surveys, producing another geological publication on that historical gold field, with complete underground and surface plans and sections. In 1916 he was engaged in the opening of the Norwell brown coal field, an area now being developed by a State Electricity Commission, and in November, 1920, was appointed to the position he now holds as Director of Geological Surveys in Victoria. Mr. Baragwanath is a member of the Institute of Surveyors, of the Australian Institute of Mining & Metallurgy, of the National Research Committee, and of the Royal Society of Victoria, as well as councillor of the Ballarat School of Mines and examiner in surveying for Victorian Technical Schools, being also on the board of examiners of mining surveyors for Victoria.

Obituary

John Dobler, well known in Yavapai mining circles, was instantly killed, recently, when he fell into the 300-ft. shaft at the Diamond Joe mine, near Wickenburg, Ariz.

Charles H. Burlock, mining engineer of San Diego, died at his home on Sept. 12, from heart failure. Mr. Burlock had extensive mining and oil interests in Arizona, California and Mexico.

Robert H. Engle, sixty-four years old, a prominent authority on zinc products, and president of the United Zinc Smelting Corporation, died recently at his home, at Trenton, N. J. Mr. Engle was also an inventor. He was a pioneer zinc manufacturer and was the organizer of the Trenton Smelting & Refining Company, Trenton, N. J. For twenty-five years he was president of the United Lead Co., of Philadelphia. At the time of his death he was president of the United Zinc Smelting Corporation and was a member of various chemical societies. He is survived by his widow and a son and daughter.

Societies, Addresses, and Reports

Need for Research Stressed at Australasian Institute Dinner

W. H. Gepp Talked at Annual Meeting
—Large Appropriations for Industrial Investigations

Replying to the toast of the "Australasian Institute of Mining and Metallurgy" at the annual dinner of the Institute at Broken Hill on Aug. 29, H. W. Gepp urged the necessity for research not only in mechanical and chemical problems, but also with regard to matters of industrial relations. The dinner was the concluding part of the successful first meeting of the Institute for 1925.

Unfortunately, said Mr. Gepp, the prosperity of the mining and metallurgical industry of Australasia could not be judged from the satisfactory conditions at Broken Hill. The gold-mining industry was struggling to maintain an existence. Owing to the price of copper being much below the parity of other metals, those in that industry were severely handicapped. It was not far from the truth to say that unless conditions improved Australia might have to import copper in the comparatively near future, in spite of the fact that large quantities of copper ore existed in Australia. The recently made agreements between the companies and employees at Broken Hill with regard to wages and conditions were an encouraging sign of co-operation and mutual understanding, which he hoped was the beginning of an era of industrial peace and goodwill.

"Following the war," added Mr. Gepp, "a great awakening in the centre of the Empire to the value of research in all its applications has come, and a considerable portion of my spare time during a recent visit to Great Britain was devoted to investigation of the active and encouraging steps being taken by the British Government, and by private corporations, to facilitate research into the activities of the Empire. The British Government Department of Scientific and Industrial Research is expending nearly £500,000 annually for this purpose, and today the Empire is much better off and much safer in this essential work than it was before 1914. Co-ordination and co-operation between the center of the Empire and the Dominions and dependencies are essential for efficient carrying on of research work and for the elimination of overlapping. We welcome the action of the Commonwealth Ministry in placing upon the estimates for the coming year the sum of £100,000 for the work of reorganizing and extending the Commonwealth Institute of Science and Industry. The more systematic and complete our research work into all the problems of all branches of mining and metallurgy in Australasia the more successful will these industries be. For these researches to bear the soundest and most profitable fruit, they must be conducted by all branches of the in-

dustry, and with the encouragement of all interested in the industry. They must not be confined to mechanical and chemical problems, but must cover the vital problems of the personal and business relations existing between the shareholders, the directors, the management, the staff, and the employees of all these vital portions of the activities of the Commonwealth."

New York Section, A. I. M. E. Meets on Tuesday

The New York section of the A. I. M. E. will meet at the Machinery Club, 50 Church St., on Tuesday evening, Oct. 20, to hear addresses by two prominent civil engineers. Robert Ridgway, president of the A. S. C. E., will speak on "The Construction of New York Rapid Transit Subways," and Ole Singstad, chief engineer of the New York and New Jersey Tunnel Commission, will discuss "The Vehicular Tunnel Under the Hudson River and Its Ventilation Problem." M. H. Merriss, secretary of the local section, who has arranged this attractive program, expects a large attendance both at the dinner, at 6:30, and at the meeting which follows.

The New York section of the American Institute of Mining & Metallurgical Engineers held its first meeting of the year on Sept. 29 at the Machinery Club, New York City. The usual dinner preceded the discussion. About 125 members were present, which is a larger attendance than many of the local meetings have attracted in the past.

The entire evening was given up to the subject of the anthracite coal industry, the strike, and the possible shortage of this fuel. The principal speaker of the evening was E. W. Parker, chief of the Anthracite Operators' Bureau of Information, Philadelphia, Pa. His topic was "The Future of the Anthracite Industry." He said that it was easier and safer to make predictions twenty-five to fifty years ahead than to say what would happen during the next four or five weeks. In his discourse he dwelt principally upon the present labor conditions and the coal supply.

Mr. Parker was followed by R. V. Norris, who discussed the "check-off," prices, wages, and profits. Roderick Stevens discussed anthracite from the dealer's point of view and the distribution of coal in the metropolitan area of New York City. C. K. Baldwin, chief engineer of the Robins Conveying Belt Co., confined his remarks to substitutes, citing coke as an important byproduct of the gas plant, the quantity of which is increasing every year. F. R. Wadleigh also discussed substitutes and the distribution of coal supply. C. P. Starr, chief of the Power Division, U. S. Chamber of Commerce, discussed the check-off and the strike situation from the public's viewpoint.

Workmen's Compensation Now Part of Arizona Constitution

Employer Pays Insurance Premium; Responsibility Then Ceases—Lawyers to Be Eliminated

At the special election held recently for the purpose, the voters of Arizona made effective an amendment to the State Constitution, which was passed by the last legislature, and which requires that all employers of three or more persons provide industrial insurance.

The new law, which is administered by a special commission with wide powers, provides an accident benefit fund which takes care of the expense of doctors, hospital, surgical operations, nurses, artificial limbs, or other incidental expense, from the time of injury, and in addition, after a seven-day period, pays compensation from the time of injury.

Not only is there compensation on 35 per cent of the wages earned by the victim at the time of the accident, but if a leg, eye, or other member is lost, causing partial disability, that man is taken care of by a rehabilitation fund and paid 55 per cent of the difference between what he was earning before the injury and what he was able to earn afterward, until his death.

Under the new law, claims are presented to the commission. The commission ascertains and determines the kind of injury. The law fixes the compensation and the insurance carrier pays. The employer has nothing to do with it; he pays only his premium.

The American Federation of Labor, through its president, William Green, is said to have endorsed the amendment and the law, "recognizing that it is in advance of any existing compensation legislation in the United States."

The general safety committee of the Clarkdale smelter has also endorsed the new law, stating that "it fills a long-felt want in the protection which it gives to injured workers and their families, and carries with it great benefits and greater protection than any other compensation act to the employees in various industries in the state."

The new law will to a large extent eliminate the necessity for the services of personal injury attorneys. Statistics cited by some of the speakers in favor of the bill are to the effect that since Arizona became a state, 1,300 personal injury cases have been taken before the Arizona courts, calling for a total amount of damages of \$14,000,000. The total collected was less than one million dollars, half of which went for attorneys' fees and costs of litigation.

Steel Institute Meets

The Twenty-eighth General Meeting of the American Iron and Steel Institute will be held at the Hotel Commodore, New York City, on Friday, Oct. 23. There will be the usual sessions, morning and afternoon, at which Judge Gary will give his address and technical papers will be read. This will be followed by a banquet in the evening.

Recent Technical Publications

Reviews, Abstracts, and References

A Reference Book for Sellers and Buyers

Hendricks Commercial Register. Thirty-third edition. 1925. Published by S. E. Hendricks Co., Inc., 70 5th Ave., New York City. Price \$12.

The new edition of Hendricks well-known reference book covers the same field as its predecessors. It has evidently been enlarged somewhat, as the present book contains over 2,500 8 x 11-in. pages, and gives evidence of having been brought as near up to date as is possible in a work of this kind. The names and addresses of manufacturing concerns and distributors is now at the front of the book. This is followed by the index to classifications to various products, and then by the classified products section itself, where, if one wishes to find who makes wood pipe, for example, he can find the names of sixteen manufacturers. Or if he wishes to buy or sell manganese ore, he can find the names of twenty firms interested in that commodity. The last section is devoted to trade names, so that if one must know, for instance, who makes Alligator steel belt lacing, he can find out. Altogether, this is an exceedingly useful reference book for any one who must buy or sell commodities.

The Metal Industry in 1922

Mineral Resources of the United States, 1922. Part 1, Metals. Edited by G. F. Loughlin. Published by U. S. Geological Survey. Sold by Superintendent of Documents, Washington, D. C. Price \$1.

The various chapters of this volume have been chronicled in these columns as they have been published, the present book being of value only for reference purposes. The work continues to be well done and forms one of the four valuable reference works for anyone wishing to have a record of the mining industries, the other three being the annual volumes of "The Mineral Industry," the annual reports of the American Bureau of Metal Statistics, and the bound volumes of a weekly magazine that we are too modest to mention.

In our issue of Nov. 4, 1922, we complained that this annual volume appears two years too late. Just to show us what he thinks of our criticism, Dr. Work sends us the 1922 issue on Oct. 14, 1925, whereas the 1921 book reached us on April 24, 1924. We shall therefore expect the 1923 volume along about April 1, 1927. E. H. ROBIE.

Recent Technical Books—The Pratt Institute Free Library, Brooklyn, N. Y., has issued a bulletin for free distribution listing the most important technical books that were issued during 1924. It will be of value to those whose duty it is to select books for local libraries.

Surveying—The *Queensland Government Mining Journal* of June 15 contains a three-page article entitled "Survey Practice" by W. H. Galletly. This

paper was read before the Institute of Mine Surveyors, Queensland, and covers the subject from the viewpoint of one engaged in survey work in Australia.

Air Bubbles—The mathematics of air bubbles of various sizes moving upward in still water are carefully treated in Vol. 5, No. 3, of the *Technology Reports* of the Tohoku Imperial University, Sendai, Japan. The bulletin is of possible interest to those making a study of the theory and design of flotation machines.

Canadian Mineral Production—A preliminary report of the mineral production of Canada for the first six months of 1925 was recently issued by the Dominion Bureau of Statistics, Ottawa, for free distribution. Copper, gold, lead, nickel, silver, zinc, asbestos, graphite, and talc all show an improvement over the corresponding period of 1924. The arsenic, bismuth, cobalt, precious metals, coal, feldspar, gypsum, magnesite, mica, quartz, salt, and petroleum produced were not valued as high as last year.

Petroleum Drilling and Storage—The American Petroleum Institute, 250 Park Ave., New York City, has issued a 112-page bulletin giving the reports of the Standardization Committees on oil field drilling and storage equipment, made at the semi-annual standardization conference of the American Petroleum Institute at Dallas, in June.

Ontario Gold—The Ontario Department of Mines has issued a revised edition of its bulletin on the "Kirkland Lake Gold Area," by A. G. Burrows and Percy E. Hopkins, including a geological map, in colors, of the district extending from Swastika on the west to Malone Lake in McVittie Township on the east. The geology of the entire district is described, with short references to the work that has been done at the various individual mines. In the bulletin is also included a report by Mr. Hopkins on "Lebel and Gauthier Townships," which is the area between Kirkland and Larder lakes. The bulletin is obtainable free of charge from the Ontario Department of Mines, Toronto.

English Copper Smelting—The Cape Copper Company's Works are described briefly in a 9-page article by Alan S. Gill, in *The Mining Magazine* for September. (London; price 1s.) This is an old smelter and refinery that has found it impossible to compete with its rivals on this side of the Atlantic, so has been closed down, though it is said that the equipment is modern.

Tennessee Geology—Bulletin 35 of the Division of Geology, Department of Education, Nashville, Tenn., is the administrative report of the State Geologist for 1923-4. (50 pages; obtainable on request.)

Rouyn, Quebec—A descriptive article concerning what has been done in the remarkable gold-copper district of Rouyn, Quebec, is published in *The Canadian Mining Journal* of Oct. 9,

entitled "The Horne and Amulet Mines." Lloyd J. Moore, financial editor of the *Toronto Globe*, is the author. (Gardenvale, Que.; price 15c.; 5 pages.)

Mineral Resources—Recent separates of "Mineral Resources," issued by the U. S. Geological Survey, Washington, D. C., and not previously reported include: "Gold, Silver, Copper, Lead, and Zinc in New Mexico and Texas in 1923," 16 pages, by C. W. Henderson; "Fulder's Earth in 1924," 3 pages, by Jefferson Middleton; and "Peat in 1924," 2 pages, by K. W. Cottrell. Obtainable free of charge.

Patents

Zinc—No. 1,553,646. Sept. 15, 1925. Filip Tharaldsen, Bestrum, near Christiania, Norway. A process of condensing zinc which comprises maintaining an unbroken surface of a molten bath of zinc with which zinc vapors contact and on which they condense. The surface is kept bright by means of a surface flow from one end to the other of the bath.

Electric Furnace—No. 1,553,618. Sept. 15, 1925. Lloyd D. Kay, Los Angeles, Cal. This, together with patent No. 1,553,619, covers an electric furnace of the tilting type of certain special design.

Roasting—No. 1,555,078. Sept. 29, 1925. F. D. S. Robertson, Toronto, assignor to J. P. Scott, Toronto. Ore is heated in a reducing atmosphere to remove all the sulphur, arsenic, and similar volatile matter, partly in the elemental condition, the residue containing the metals in the metallic state.

Silver Extraction—No. 1,555,615. Sept. 29, 1925. F. W. Weber, Hackensack, N. J. Silver sulphide ores are treated with hot nitric acid to dissolve the sulphides other than silver, though some of the silver is also dissolved. The residue is then separated from the solution, and the solution treated with an alkali metal chloride solution, thereby precipitating the dissolved silver sulphate in the form of silver chloride, which is separated. The silver chloride and undissolved silver sulphide are then combined and reduced in any of the well-known ways.

Rock Drills

No. 1,554,984. Sept. 29, 1925. L. C. Bayles, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. A fluid-actuated distributing valve for rock drills.

No. 1,556,213. Oct. 6, 1925. E. G. Gartin, Claremont, N. H., assignor to Sullivan Machinery Co. A drill sharpening mechanism.

No. 1,553,897. Sept. 15, 1925. George H. Glaser, Winthrop, Mass. Assignor to George H. Gilman, Belmont, Mass. A hammer drill of a certain specified design.

No. 1,554,003. Sept. 15, 1925. Charles C. Hansen, Easton, Pa. Assignor to Ingersoll-Rand Co., Jersey City, N. J. A valve chest for rock drills.

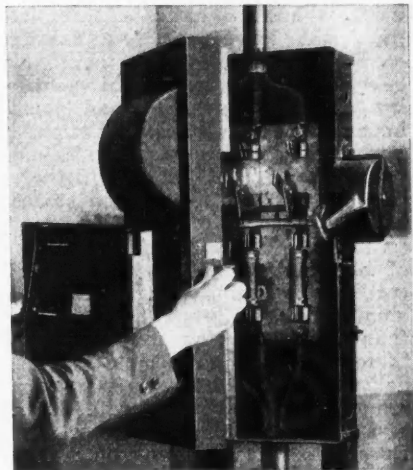
Rotary Bit—No. 1,554,160. Sept. 15, 1925. William L. Howlett and John W. Heaston, Huntington Beach, Cal. A rotary bit with several helical blades and made of manganese.

New Machinery and Inventions

A Safety Switch of Foolproof Design

Exposed switches are frequently seen in plants where motors are installed but they possess several disadvantages over the boxed-in type. They are not so safe for the operator to manipulate, they collect dirt, they are unsightly, and any passerby can throw the current on or off, without authority to do so.

A new safety switch known as WK-55 has been introduced by the



A new inclosed switch

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., the design of which provides full safety for the operator and the motor under all conditions. To eliminate the possibility of the operator coming in contact with live parts, the switch has a double-door construction, a smaller door within the main door giving access to the fuse compartment. This fuse compartment door is interlocked with the operating handle so that it will not open until the switch is thrown to the off position. In this position, even with the door open, no live parts are accessible and as long as the door remains open the switch cannot be thrown on. The outer door covering the entire switch inclosure may be padlocked, and can be opened for inspection and testing without interrupting the service.

The new design removes the danger of loose parts coming into contact with current-carrying parts of the switch which would cause dangerous short-circuit hazards. There is ample space for all wiring. An arc quencher of simple design serves to extinguish the arc quickly and efficiently when the circuit is open.

A New Form of Asphalt Coating

In metallurgical plants, asphalt linings are often used in tanks and to cover surfaces which must be made impervious to water or certain chemicals. Ordinarily asphalt, or other bituminous material, is applied hot, or a compound is used. A new development permits an asphalt of known properties and of known quality to be deposited on steel, concrete, wood or other structural

surface without the aid of heat or of asphalt solvents. Hydralt, as it is called, consists of asphalt broken up into minute particles in the presence of water, the particles being held in suspension indefinitely. The water facilitates spreading the material, and later evaporates, permitting the asphalt particles to flow together, forming a continuous asphalt sheet over the surface. The chief advantage claimed for the material is that the asphalt is of known qualities whereas cold applications made possible by the use of solvents are often completely altered from their original and determinable state. Since the sheet of asphalt as applied contains no volatile oils, it will not become brittle and will not crack, flake or peel. Hydralt is applied as a soft semi-fluid paste with either a brush or a spray. Its covering capacity is about 80 sq. ft. per gal. per coat.

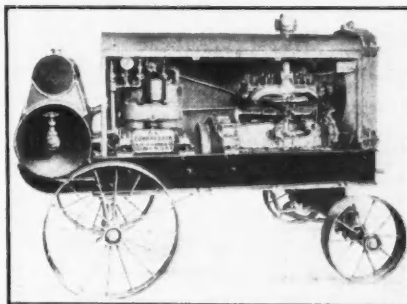
This new product is manufactured by J. W. Gardner, Inc., New York, N. Y.

New Series of Portable Compressors Offered

Portable air compressors are frequently employed at small operations where the equipment is of a temporary nature. A new series of three machines, identical in type, of a capacity of 118, 160, and 260 cu. ft. of free air per min., is being manufactured by the O. K. Clutch & Machinery Co., of Columbia, Pa. The frames are of structural steel channels joined by electric arc welding. The radiators are of special design and are claimed to be unbreakable from any freezing action. The engine is a four-cylinder four-cycle design direct connected to the compressor by a special clutch and coupling.

The compressor is of heavy construction, extra thick cylinder walls being provided for re-boring purposes. The cylinders are completely surrounded by a water jacket and all adjustable parts are easily accessible. Valves are removed by taking off bolted caps instead of the whole cylinder head, and large hand holes are provided on each side of the crankcase. Pistons, connecting rods and crankshaft are made of chrome vanadium steel.

The units are mounted on a truck with steel- or rubber-tired wheels and are completely enclosed in steel housings. The weights are 3,200, 4,500, and 6,000-lb. respectively.



Compressor as mounted

Industrial Bulletins

Filtration — Thickeners and filters adapted to dewatering mineral concentrates have so far been of rather limited variety; though widely used, only two or three manufacturers have invaded the field. The Genter thickener has been on the market for several years, but it is only recently that a companion machine has been built to dewater the thickened pulp and make a filter cake dry enough to ship. This is known as the Industrial Continuous Filter, and is being put on the market by the Industrial Separators Co., Inc., Woolworth Building, New York City. The machine is of the rotary drum type and is described in a recent bulletin.

Heat-resisting Alloys—A paper on "Heat-resisting Alloys," presented at the Tenth Exposition of Chemical Industries, in New York, has been republished for general distribution by Arlington Benschel, 300 Madison Ave., New York City. The author is Victor Hybinette, of Wilmington, Del., who has made a specialty of the metallurgy of nickel, and is now engaged in the manufacture and sale of heat-resisting metals. Most of the standard alloys contain nickel, chromium, and iron in varying proportions. Approximately equal parts of the three are said to give the highest degree of heat resistivity and to be far more immune to alkali compounds under oxidizing conditions than any other combination of the three metals or any two of them.

Underflow Control—The Bradley automatic density valve, or underflow control, is described in a four-page bulletin issued by the Thyle Machinery Co., of San Francisco.

Stop Watch—The use of stop watches is not confined entirely to the habitués of race tracks; many uses for these instruments may be found about industrial plants where time studies are being made, and in laboratory work. A circular describing the O-Z laboratory timer stop watch has recently been issued by O. Zernickow Co., 15 Park Row, New York City. This instrument is said to embody some real and important improvements in design which do away with the ever-recurring repairs which characterize so many split-second timepieces.

Automatic Switching—"Automatic Switching Equipment for Reclosing Service on 275-volt D. C. Circuits" is the title of an attractive bulletin recently issued by the General Electric Co., Schenectady, N. Y. The installation of automatic equipment in most mining substations is justified, says the bulletin, by the monetary saving arising from the reduction of operating expense. At the same time, other benefits may be derived, such as service improvement, reduced maintenance on apparatus, and economy in feeder copper through a possible rearrangement of feeders.

Coal-Handling Equipment—The new power plant of Purdue University, at La Fayette, Ind., is illustrated, with brief description of the coal handling, weighing, and storing equipment, in a folder just issued by the Freeman-Riff Co., manufacturers, Terre Haute, Ind.

The Market Report

Lead Steady as Other Metals Climb

Copper Reaches 14.625c. With Good Business—Rapid Advance of Zinc and Tin Features Markets—Silver Seems Steady, With Limited Supplies

New York, Oct. 14, 1925—An advance of a full quarter of a cent as compared with last Wednesday, in the zinc market, and a similar improvement in copper, are the features of the week ending today. Zinc is probably firmer at the higher price than copper, though no disposition to shade the price of the

latter has been manifested by producers. The lead market is steady, with purchases on a good scale at 9.50c. New York and 9.25c. in St. Louis. Tin also advanced sharply, and silver has improved somewhat during the week, though a slight decline is recorded today.

Copper Regains Lost Ground

After declining to 14.375c., delivered, a week ago, copper is back at 14.625c., at which figure a substantial business has been done since Monday at normal freight rate points. One small lot for Western delivery brought 14.75c. An "adjudication," by the French Government, which is a notice of intention to purchase a large quantity of fabricated copper products, last Friday, had the effect of waking up the European market. London advanced, and domestic buyers came into the market simultaneously with an increase in prices on the part of producers. A still further decline of nearly 4,000 tons in stocks of refined copper as of Oct. 1 is offset by an increase of 5,000 tons in the supply of blister, but the statistical position certainly remains excellent. Recent shipments to Europe have been less than those of a few months ago, and there is also a slight decline in domestic deliveries. Consumers in this country are using metal at a high rate, however, and all that seems necessary is for Europe to resume buying on a reasonably large scale. It remains to be seen whether the recent foreign business is a mere spurt or the starting of a period of steady buying.

Daily Prices of Metals

Oct.	Copper N. Y. net refinery*		Tin		Lead		Zinc	
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.	St. L.	
8	14.125	59.125	60.875	9.50	9.25	8.05@8.10		
9	14.25	59.50	61.75	9.50	9.30	8.10@8.15		
10	14.25@14.375	59.50	61.75	9.50	9.25	8.15		
12	Holiday							
13	14.325@14.375	60.25	62.125	9.50	9.25@9.30	8.20		
14	14.375	60.625	62.50	9.50	9.25	8.25@8.275		
Av.	14.283	59.800	61.800	9.50	9.265	8.163		

*The prices correspond to the following quotations for copper delivered: Oct. 8th, 14.375c.; 9th, 14.50c.; 10th, 14.50@14.625c.; 12th, Holiday; 13th, 14.575@14.625c.; 14th, 14.625c.

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.

Zinc Stocks Down; Prices Up

The zinc situation is more than satisfactory to producers, prompt metal being in particular demand and supplies being limited. It is generally believed that one important British interest controls most of the prompt metal abroad. This has pushed up foreign prices and has been reflected in the domestic market. At the same time brass and galvanizing companies in this country find that they are not well covered for early needs, and as business is good with them the zinc market is very active. The American Zinc Institute issues the following figures in tons of 2,000 lb. for September:

Stock, Sept. 1..... 17,032
Produced 47,384

Shipped 64,416
Stock, Sept. 30..... 11,796
Shipped from plant for export.. 6,074
Stored for customers..... None
Retorts operating Sept. 30..... 86,556

London

Oct.	Copper			Tin		Lead		Zinc	
	Standard Spot	3M	Electrolytic	Spot	3M	Spot	3M	Spot	3M
8	61 $\frac{1}{4}$	62 $\frac{1}{8}$	66 $\frac{3}{4}$	271	272	39	36 $\frac{1}{2}$	39 $\frac{1}{8}$	37 $\frac{1}{16}$
9	62 $\frac{1}{8}$	63	67 $\frac{1}{4}$	274 $\frac{1}{8}$	275 $\frac{1}{8}$	39 $\frac{1}{2}$	36 $\frac{1}{16}$	39 $\frac{1}{2}$	38 $\frac{1}{16}$
12	62 $\frac{1}{8}$	63 $\frac{1}{2}$	68	274 $\frac{7}{8}$	275 $\frac{7}{8}$	39 $\frac{1}{2}$	36 $\frac{3}{8}$	39 $\frac{1}{8}$	38 $\frac{9}{16}$
13	62 $\frac{1}{2}$	63 $\frac{3}{8}$	68 $\frac{1}{8}$	277 $\frac{1}{4}$	277 $\frac{3}{4}$	39	36 $\frac{1}{2}$	40	38 $\frac{7}{16}$
14	62 $\frac{3}{8}$	63 $\frac{3}{8}$	68	279	279 $\frac{1}{2}$	39 $\frac{1}{8}$	36 $\frac{1}{16}$	40 $\frac{7}{16}$	39 $\frac{3}{8}$

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

Silver, Gold, and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver			Gold London	Oct.	Sterling Exchange "Checks"	Silver			Gold London
		New York	London	London				New York	London		
8	4.83 $\frac{3}{4}$	70 $\frac{7}{8}$	32 $\frac{1}{16}$	84s11 $\frac{1}{2}$ d	12	33	84s11 $\frac{1}{2}$ d		
9	4.83 $\frac{3}{4}$	71	32 $\frac{1}{8}$	84s11 $\frac{1}{2}$ d	13	4.83 $\frac{3}{4}$	71 $\frac{1}{2}$	33 $\frac{1}{8}$	84s11 $\frac{1}{2}$ d		
10	4.83 $\frac{3}{4}$	71	32 $\frac{1}{8}$		14	4.83 $\frac{3}{4}$	71 $\frac{1}{4}$	32 $\frac{1}{16}$	84s11 $\frac{1}{2}$ d		

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

Lead Steady at 9.50c. and 9.25c.

There is little new in the lead market. Sales have been in good volume, particularly in the Middle West, where the leading interest is offering quite freely at 9.25c. during the remainder of the year. The American Smelting & Refining Co. continues to maintain its official contract price for New York lead at 9.50c. Last Thursday, Friday, and Saturday some lead brought 9.45c. for spot shipment in St. Louis, but in-

dications are that those asking premium prices are having great difficulty in finding buyers this week. Manufacturers of lead-covered cable continue to be extremely active buyers, and battery makers and manufacturers of "blue" lead products are also large buyers.

Tin Reaches 62.50c.

The marked improvement in the tin market, which made a net gain of 2.625c. during the week, is accounted for in two ways: statistically, tin is in a remarkable position and American consumers who have been buying on a hand-to-mouth basis are coming strongly into the market. At the same time speculative interests, encouraged by the consuming demand, are bullish on the market. These factors combined could have but one effect, that is, a rapid increase in the price.

Silver Steady

Orders from China and India over the Columbus Day holiday caused another advance on Oct. 13 in London and New York, but a reversal of China's position on the following day brought a reaction in London. This drop was reflected to some extent in New York, but the local price holds very well and the market appears steady with limited supplies.

Mexican Dollars: Oct. 8th, 54½c.; 9th and 10th, 54½c.; 12th, a holiday; 13th, 55c.; 14th, 54¾c.

Francs and Lire Weak

Sterling has been unchanged all week, but francs and lire have weakened, owing to the solemn warning by the United States Government that something must be done toward paying war debts before any more loans would be forthcoming. Closing cable quotations on Tuesday, Oct. 13, were: francs, 4.52c.; lire, 3.95c.; and marks, 23.81c. Canadian dollars, ½ per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, 98 per cent, £118@£120 per long ton.

Antimony—

Chinese brands, spot, 17½c. per lb.; October, 16¾@17¾c.

Demand is only moderate but arrivals are scant and price is firm for spot. Cookson's "C" grade, needle, and oxide nominally unchanged from quotations in the Oct. 3 issue.

London, English special regulus, £75@£80. Foreign, spot £66@£66 10s.

Bismuth—\$2.65@£2.70 per lb., in ton lots. London, 10s.

Cadmium—60c. per lb. London, 1s. 9d.

London has declined from 2s. 3d., but the domestic market is firm.

Iridium—\$395 per oz. for 98@99 per cent. Nominal. London, £80@£85.

Nickel—Ingot, 33@34c.; shot, 34@35c.; electrolytic, 38c.; London, £170@£175 per long ton.

Palladium—\$80@£83 per oz. Crude, \$65. London, £16, nominal.

Platinum—\$120 per oz. refined officially quoted. Sales also at \$115@£118.

Crude, \$113.50@£114.25. London, £24 10s.@£25 per oz. for refined; crude £22@£22 10s.

Quicksilver—\$82@£83, spot; \$81.50, forward per 75-lb. flask. San Francisco, \$80.83. London, £13 10s.

Ruthenium—\$90@£95.

The prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmiridium, Osmium, Radium, Rhodium, Selenium, Tantalum, Tellurium, Thallium, Tungsten and Zirconium are unchanged from the Oct. 3 issue.

Metallic Ores

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports: Brazilian, 42@44c., nominal; Indian, 44c., nominal; Caucasian (unwashed), 42c.; Caucasian (washed), 44c. Demand moderate, but price firm.

Tungsten Ore—Per unit of WO₃, N.Y.: High-grade wolframite, \$12.25; ordinary quality, \$11.50@£11.75; high-grade Western scheelite, \$12@£12.50. Market quiet as a consequence of large buying during the last month.

Chrome Ore—Indian ore—second grade—offered c.i.f. New York at \$19 per long ton. High-grade Indian ore, \$22@£23. Rhodesian ore offered at \$23. Prices, largely nominal.

Galena and Pyrite Radio Crystals, Iron Ore, Molybdenum, Tantalum, and Vanadium Ores are unchanged from quotations in the Oct. 3 issue.

Lead Ore Higher—Sellers Holding Zinc

Joplin, Mo., Oct. 10, 1925

Zinc Blende	Per Ton
High	\$58.80
Premium, basis 60 per cent zinc	\$57.00@£58.00
Prime Western, 60 per cent zinc	\$56.00
Fines and slimes, 60 per cent zinc	\$55.00@£51.00
Average settling price, all...	\$54.33

Lead Ore

High	\$126.99
Basis 80 per cent lead.....	\$120.00
Average settling price, all...	\$113.84

Shipments for the week: Blende, 16,397; lead, 1,507 tons. Value, all ores the week, \$1,061,380.

Buyers and sellers of zinc ore differed \$1 per ton on price quotations, and very little ore was purchased at 5 o'clock this afternoon. At 6:10 purchase of 12,480 tons was completed.

Shipment of lead purchased in August is practically ended, as the abrupt drop in the average settling price records, and shipments also disclose that sales of lead are restricted. The advance of \$5 this week may bring a slightly increased tonnage onto the market.

Platteville, Wis., Oct. 10, 1925

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc.....	\$57.75

Lead Ore

Lead, basis 80 per cent lead.....	\$120.00
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Shipments for the week: Blende, 865 tons; lead, 80 tons. Shipments for the year: Blende, 37,006; lead, 1,801 tons. Shipments for the week to separating plants, 1,600 tons blende.

Non-Metallic Minerals

Amblygonite, Andalusite, Asbestos, Barytes, Bauxite, Beryl, Borax, Celestite, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the Oct. 3 issue.

Mineral Products

Arsenious Oxide (White arsenic)—3.50c. per lb.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and Zinc Oxide are unchanged from prices in the Oct. 3 issue.

Ferro-Alloys

Ferrotungsten — \$1.15 per lb. contained W. Market firm, with tendency toward better price.

Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferro-uranium and Ferrovandium are unchanged from the prices in the Oct. 3 issue.

Metal Products

Rolled Copper — Sheets, 22¾c.; wire, 16¾c. per lb.

Nickel Silver—29¾c. per lb. for 13 per cent nickel Grade A sheets.

Yellow (Muntz) Metal—Sheets, 20¾c. per lb.; rods, 17¾c.

Lead Sheets—Rolled, 13¾c.; clipped, 13¾c.

Zinc Sheets—11c. per lb., f.o.b. works.

Refractories

Chrome Brick, Firebrick, Magnesite Brick, Silica Brick, and Zirkite are unchanged from prices in the Oct. 3 issue.

Steel Steady—Pig Iron Quiet—Coke Slightly Higher

Pittsburgh, Oct. 13, 1925

After six months of decreases, the Steel Corporation's unfilled obligations increased by 204,494 tons in September. There were losses in one or two lines, more than made up by gains both in current business and in forward business, including in particular rails for next season.

Pig Iron — The Pittsburgh-Valley market continues quiet, with prices easily held firmly, on account of light production, at \$19.50 for bessemer, \$18.50 for basic, and \$19 for foundry, f.o.b. Valley furnaces.

Connellsville Coke—A little further increase in demand for furnace coke, from miscellaneous buyers, largely in the east, has cleaned up the lower-priced offerings, and sales have been made at \$4.25 and \$4.50, or 75c. advance within a fortnight. As some coke was being held, the market may not advance farther for a while. Spot foundry sluggishly responds and may be quoted already a little higher, at \$4.25@£4.75.

Company Reports

Cresson Consolidated Gold M. & M. Co.

Gold; Colorado

The report of the Cresson Consolidated Gold M. & M. Co. for the third quarter of the year, shows net profit, after deduction of all expenses, treatment and transportation charges, as follows:

	Net Tons	Average Gross Value	Net Returns
July	8,510	\$20.44	\$67,589.93
August	9,027	17.11	51,534.77
September (estimated)	10,000	17.00	65,000.00
Totals	27,537	\$18.00	\$184,124.70

The orebodies under the 17th level are proving larger than expected, and in one position the ore has extended to the 18th level. The 19th level is being driven both east and west along the contact. Ore should be developed in the next quarter by this work.

Development work on the 20th level, owing to large flow of water, has been confined to raising on the ore to make a connection with the 19th level.

As of Sept. 30, 1925, the company had cash in bank amounting to \$1,331,363.61.

Broken Hill Proprietary Co.

Lead, Zinc; Australia

The Broken Hill Proprietary Co. report for the year ended May 31, 1925, states that work at Broken Hill, both underground and on the surface, has been practically continuous, with the exception of the period covered by the Christmas and Easter holidays, and that the results obtained have been eminently satisfactory.

Experiments are being conducted with the object of recovering the oxidized lead from the residues of the slime flotation plant (Bradford process), produced when treating dump slimes. The output of ore for the year was 126,191 tons. Production included 7,113 tons of jig lead concentrate; 16,674 tons of lead flotation, and 15,261 tons of zinc flotation concentrate.

The net profit for the period under review amounted to £372,306 11s. 8d., after providing £213,518 4s. 2d. for ordinary depreciation and £75,000 for special depreciation. One dividend of 1s. per share, absorbing £123,613 15s., was paid during the period under review.

Working Account

Debit		Credit	
To wages, salaries, and expenses:			
Assaying	£5,858	18	6
Electric power and light	8,630	11	8
Experiments and researches	705	12	4
Fuel and fluxes, timber and water	126,119	13	9
Freight, insurance, and charges on products	87,413	7	4
Mining, maintenance, and prospecting	210,213	18	1
Machine shop	12,889	12	4
Sulphuric acid	4,875	7	10
Traction and tram maintenance	5,823	8	3
Separation plants expenses	6,603	3	9
Iron and steel	3,409,170	0	2
Balance carried to profit-and-loss account	£3,932,303	14	0
	692,590	2	4
	£4,624,893	16	4
By sales of products and stocks on hand			
	£4,624,893	16	4

Tonopah Belmont Development Co.

Silver, Gold; Nevada

A condensed statement of the operations of the Tonopah Belmont Development Co. for the six months ended June 30, 1925, shows the following:

Received and receivable for ore	\$282,777.31
Mining, milling, and administration expenses	267,040.99
Net earnings for six months	\$15,736.32
Miscellaneous income	581.76
Dividend from Belmont Surf Inlet Mines, Ltd.	50,000.00
Total net income for six months ended June 30, 1925	\$66,318.08

Available Resources, Aug. 31, 1925

Due from smelter	\$33,582.02
Due from others	6,571.09
Cash in banks	400,290.99
Liberty bonds	50,031.25
Total	\$490,475.35

The net earnings for the six months ended June 30, 1925, of the Belmont Surf Inlet Mines, Ltd., of which this company owns 80 per cent, were \$181,160.62.

California Rand Silver, Inc.

Silver; California

The report of the California Rand Silver, Inc., for the year ended July 31, 1925, shows the following:

Statement of Production

Total ounces gold, 9,447,222, gross value	\$179,736.97
Total ounces silver, 2,482,139.89, gross value	1,704,357.24
Total gross value gold and silver	\$1,884,094.21
Less:	
Penalties and deductions	\$87,275.95
Freight charges	81,041.72
Treatment charges	78,695.69
Total deductions	247,013.36
Total net value, gold and silver	\$1,637,080.85
Net value one car of ore	5,252.52
Total net value	\$1,642,333.37

Receipts and Disbursements

Receipts		Disbursements	
Balance as of Aug. 1, 1924			
Remittance from smelter	\$1,683,611.57		\$86,712.02
Interest earned	12,719.29		
Petty cash deposited	11,951.65		
Unclaimed checks	93.20		
Dividend in litigation transaction	1,374.10		
Balance from sale escrow	1,100.66		
Total	\$1,710,850.47		
Transfer from savings account	275,000.00		1,985,850.47
			\$2,072,562.49
Payroll			
Material and service	\$423,440.86		
Accounts receivable	363,415.56		
Taxes paid	2,639.39		
Compensation insurance	117,601.31		
	14,693.66		
Total	\$921,790.78		
Dividends paid	755,200.00		1,676,990.78
			\$395,571.71
Transfer to savings account			350,000.00
Balance checking account as of Aug. 1, 1925			\$45,571.71

The last detailed estimate of the assured ore reserves, made in March, 1924, showed 74,400 tons, of an average value of \$23.08, based on silver at 65c. per ounce. Since then, or for the period from Feb. 1, 1924, to July 1, 1925, the mine has produced 118,138 tons of ore of average grade \$22.14. A comparison of the present tabulated estimate of ore reserves with that of Feb. 1, 1924, shows that the present reserves are about the same as they were at that time.

Estimate as of Feb. 1, 1925—74,400 tons, at \$23.08..... \$1,717,400
Estimate as of July 1, 1925—88,500 tons, at \$21.39..... 1,893,000

This shows that the development work during the intervening period opened up new orebodies whose gross value was over two and a half million dollars.

A detailed study of the past mining, milling, and marketing costs, together with other items such as taxes and tailing losses, shows that the net value of the above ore reserves is \$566,400. The history of the mine and recent development work indicate the possibilities of opening up bodies of ore not included in the estimates given herewith. In the course of development work a large tonnage of ore has been opened up assaying from 6 to 12 oz. in silver, that under more favorable operating conditions may yield a profit. The indicated tonnage of this class of material would total several hundred thousand tons.

In July, the work of deepening the No. 2 shaft was started, and at the present rate of progress the additional 500 ft. in depth should be secured about Jan. 1, 1926.

Benguet Consolidated Mining Co.
Gold; Philippine Islands

The report of the Benguet Consolidated Mining Co. for the half year ended June 30, shows that a production of 47,200 tons of ore, of an average value per ton of 30 pesos, was treated. The gross value of gold and silver produced was 1,303,050.18 pesos. Net profit for the six months was 552,432.16 pesos.

The following is a summary of receipts and expenditures:

Receipts	Pesos	Pesos
Bullion.....	1,307,396.62	
Exchange.....	4,040.12	
Interest.....	7,095.90	
Store operation.....	10,976.77	
Rentals.....	2,068.55	1,331,577.96
Expenditures:		
Labor.....	216,222.17	
Supplies.....	219,091.42	
Taxes.....	48,451.89	
School and hospital.....	12,677.79	
Insurance.....	2,339.82	
Marketing bullion.....	10,697.69	
Mine miscellaneous.....	38,532.43	
Manila office.....	27,890.37	575,903.58
Gross profit.....		755,674.38
Less depreciation.....	95,743.44	
Less development written off.....	66,062.76	
Less Calvin Horr option written off.....	25,271.07	
Less sundry accounts written off.....	500.02	
Less reserve for ore depreciation.....	1,500.00	189,077.29
		566,597.09
Less bonus to general manager.....		14,164.93
Net profit.....		552,432.16

Expenditures were made totaling 120,402.24 pesos for additions to plant and equipment out of profits.

Ore reserves estimated as of June 30, 1925, were as follows:

	Tons	Pesos
Positive ore—exposed on four sides.....	83,976	2,908,154.00
Probable ore—exposed on at least one side.....	63,225	1,876,808.00
Total.....	147,201	4,784,962.00

Vipond Consolidated Mines, Ltd.
Gold; Ontario

The report of the Vipond Consolidated Mines for the year ended July 31, 1925, states that the mine and mill were in continuous operation throughout the year and produced gold bullion of the value of \$582,925.66. The non-operating earnings amounted to \$5,822.48, making the total revenue during the year \$588,748.14. The cost of production amounted to \$473,378.64, leaving a profit from operations and miscellaneous earnings of \$115,369.50 before writing off depreciation for the year and development charges carried forward from previous years.

The production represents a recovery of \$9.66 per ton of ore milled, the operating costs amounting to \$7.84 per ton milled and the operating earnings being \$1.82 per ton milled. The question of tailings disposal became acute during the year, and to secure the requisite ground for this purpose the directors found it necessary to obtain the controlling interest in Inspiration Gold Mines, Ltd., at a cost to date of \$82,759.93.

Balance Sheet, July 31, 1925

Assets	
Capital	
Mining claims and properties as per balance sheet July 31, 1924.....	\$1,432,442.84
Mine, mill, camp and office buildings, plant, machinery and equipment.....	315,092.77
	\$1,747,535.61
Current.....	285,518.10
Deferred	
Development expenditures undisturbed.....	\$142,602.62
Sundry.....	12,331.59
	154,934.21
	\$2,187,987.92
Liabilities	
Capital	
Capital stock	
Authorized and issued (2,000,000 shares at \$1 per share).....	\$2,000,000.00
Surplus.....	58,368.24
	\$2,058,368.24
Current.....	37,205.31
Reserves	
Reserve for depreciation of buildings, plant, and machinery.....	\$87,598.58
Reserve for taxes.....	4,815.79
	92,414.37
	\$2,187,987.92

Operating Account For the Year ended July 31, 1925

Expenditure	
Development.....	\$97,900.56
Mining, including hoisting.....	184,804.82
Crushing, conveying and milling.....	93,939.11
Shipping and marketing bullion.....	5,505.65
General camp maintenance.....	12,829.11
Administration and general expense, mine.....	32,456.51
Administration and general expense, Toronto office.....	7,029.80
Transfer, legal and directors' fees.....	20,416.20
Insurance.....	15,235.66
Provincial and municipal taxes.....	3,261.22
Balance carried down.....	115,369.50
	\$588,748.14
Revenue	
Bullion proceeds.....	\$582,925.66
Bond and bank interest earned.....	\$5,520.52
Foreign exchange.....	257.21
Miscellaneous earnings.....	44.75
	5,822.48
	\$588,748.14

Profit-and-Loss Account

Redemption of pre-production development costs.....	\$75,430.00
Reserved for plant depreciation.....	30,124.08
Reserved for dominion income taxes.....	452.77
	\$106,006.85
1924 adjustment (compensation insurance and provincial taxes).....	2,510.43
Surplus July 31, 1925, carried to balance sheet.....	58,368.24
	\$166,885.52
Surplus July 31, 1924.....	\$51,516.00
Balance brought down.....	115,369.52
	\$166,885.52

Ore Reserves

The total ore reserves of what may be described as developed ore are estimated at approximately 250,000 tons, of a total value of about \$2,400,000. This total obviously does not take into account ore indicated by diamond-drill holes in several parts of the property. Of the developed ore approximately 56,000 tons, of an estimated value of \$520,000, is broken.

Increase in U. S. Lead Production Offset by Declines Elsewhere

Figures of the American Bureau of Metal Statistics in tons of 2,000 lb., show a decline the monthly output of pig lead by certain important countries which in 1923 furnished about 78 per cent of the world's total, and in 1924 about 79 per cent. The data follow:

United States Lead Production in 1925

	May	June	July	Aug.	Jan.-Aug
United States (a).....	47,316	48,775	46,552	47,132	374,947
Mexico.....	17,468	16,776	17,208	16,680	135,674
Canada.....	9,211	8,736	9,466	10,118	81,645
Total North America (d).....	73,995	74,287	73,226	73,930	592,266
Spain and Tunis (c).....	12,363	10,807	9,216	8,213	83,632
Italy.....	603	457	2,289	(b) 2,714	8,063
Australia.....	13,205	12,980	14,465	12,534	103,669
Burma.....	4,089	4,092	4,260	4,260	34,464
Rhodesia.....		339	680	620	2,167
Transvaal.....	284	274	168	194	1,164
Total.....	104,539	103,236	104,304	102,465	825,425

(a) Crude lead; includes only production reported by smelters who are members of this Bureau. Pig lead produced from Canadian and Mexican ores has been deducted and credited to its country of origin. (b) Estimated or partly estimated. (c) Partial. (d) The total for North America is a correct statement of the aggregate production of crude lead by the smelters of the several countries, but the distribution according to countries is not precise, particularly as between the United States and Canada, an accurate allocation by months being at present impossible.

Germany Leading Copper Importer

Figures of the American Bureau of Metal Statistics show Germany to be the most important importer of copper, with the United Kingdom second. France falls behind her record of 1924.

Copper Imports of Foreign Countries

	In Metric Tons		1925	
	Average Monthly Net Imports 1923	1924	Average Monthly Net Imports	Number of Months Reported
United Kingdom.....	5,848	10,162	11,549	8
Belgium.....	639	926	793	4
Italy.....	3,525	4,366	4,410	4
France.....	9,005	11,281	9,714	7
Sweden.....	797	1,083	690	6
Germany.....	5,926	8,059	20,078	7
Czechoslovakia.....	722	1,021	957	7
Switzerland.....	780	940	766	6
British India.....	243	189	199	6
Japan.....	469	551	108	3

Mining Stocks—Week Ended October 10, 1925

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Anaconda.....	New York	45	43½	44	Oct. 17, No. 23, Q 0.75
Arcadian Consol.....	Boston	*90	*90	*90	
Ariz. Com'l.....	Boston	12½	11½	12½	Jy. 21, Jy. 31 SA 0.50
Calaveras.....	N. Y. Curb	2	2	2	
Calumet & Arizona.....	New York	51½	50½	50½	Se. 4, Se. 21 Q 1.00
Calumet & Hecla.....	Boston	14½	14	14½	Au. 31, Se. 15 Q 0.50
Canario Copper.....	N. Y. Curb	8½	7½	8	
Cerro de Pasco.....	New York	54	52½	53½	Au. 21, Se. 1, Q 1.00
Chile Copper.....	New York	34½	33½	34½	Sep. 2, Sen. 28, Q 0.62½
Chino.....	New York	21½	20½	20½	Sept., 1920 0.37½
Con. Coppermines.....	N. Y. Curb	2½	2½	2½	
Copper Range.....	Boston	21	19½	20	Ap. 9, My. 4 1.00
Crystal Copper.....	Boston Curb	*37	*31	*34	
East Butte.....	Boston	4½	4	4½	Dec., 1919 0.50
First National.....	Boston Curb	*17	*15	*15	Feb., 1919 0.15
Franklin.....	Boston	*1	*85	*85	
Grauby Consol.....	New York	19½	18½	19½	May, 1919 1.25
Greene-Canaan.....	New York	12½	12½	12½	Nov., 1920 0.50
Hancock.....	Boston			*75	
Howe Sound, New, r. t. c.	New York	24½	23½	24½	Oct. 5, Oct. 15 Q 0.50
Inspiration Consol.....	New York	27	26½	26½	Se. 17, Oct. 5, Q 0.50
Iron Cap.....	Boston Curb	3	2½	2½	May, 1923 0.15
Isle Royale.....	Boston	12½	11½	12½	Sept., 1923 0.50
Jerome Verde Dev.....	N. Y. Curb	*50	*50	*50	
Kennecott.....	New York	56	53½	55½	Se. 11, Oct. 1 Q 0.75
Lake Copper.....	Boston	11	10	11	Jan. 1, Jn. 15 Q 0.50
Magna Copper.....	New York	42½	41	42½	Oct. 1, Oct. 15, 0.75
Mason Valley.....	N. Y. Curb	2	2	2	
Mass Consolidated.....	Boston	*70	*70	*70	Nov., 1917 1.00
Miami Copper.....	New York	9½	8½	9½	No. 2, No. 16 Q 0.25
Mohawk.....	Boston	32½	30½	32½	Aug. 1, Sept. 2 1.00
Mother Lode Con.....	New York	7½	7	7½	Jn. 12, Jn. 30 0.37½
Nevada Consol.....	New York	15½	13½	14½	Sept., 1920 0.25
New Cornelia.....	Boston	19½	18½	19½	Aug. 7, Aug. 24 0.25
North Butte.....	Boston	1½	1½	1½	Oct., 1918 0.25
Ohio Copper.....	N. Y. Curb	*85	*81	*83	No. 14, De. 2 0.05
Old Dominion.....	Boston	19½	19½	19½	Dec., 1918 1.00
Phelps Dodge.....	Open Mar.	†135	†133		Se. 19, Oct. 2 Q 1.00
Quincy.....	Boston	24½	24	24½	Mar., 1920 1.00
Ray Consolidated.....	New York	13½	12½	13½	Dec., 1920 0.25
Ray Hercules.....	N. Y. Curb			14	
St. Mary's Min. Ld.....	Boston	35½	34	35	Ap. 20, My. 20 3.00
Shannon.....	Boston	*60	*60	*60	Nov., 1917 0.25
Shattuck Arizona.....	New York	6	6	6	Jan., 1920 0.25
Superior & Boston.....	Boston	1½	1	1½	
Tenn. C. & C.....	New York	13	12½	12½	De. 31, Ja. 15, Q 0.25
United Verde Ex.....	N. Y. Curb	26	25½	25½	Oct. 6, Nov. 20 0.75
Utah Copper.....	New York	95½	95	95	Se. 18, Se. 30, Q 1.00
Utah Metal & T.....	Boston	*78	*74	*75	Dec., 1917 0.30
Victoria.....	Boston			*40	
Walker Mining.....	Salt Lake	1.90	1.80	1.90	

NICKEL-COPPER					
Internat. Nickel.....	New York	33½	32½	33	Se. 11, Se. 30, Q 0.50
Internat. Nickel pfd.....	New York	100½	99	99	Oct. 15, No. 2, Q 1.50

LEAD					
Carnegie Lead & Zinc	Pittsburgh	16	15	16	
Glud-tone M. M. Co.	Spokane	*24	*23½	*23½	Jy. 1, Jy. 10 0.01
National Lead.....	New York	160½	158	159	Sep. 11, Sep. 30 2.00
National Lead pfd.....	New York	116	116	116	Aug. 21, Sep. 15 1.75
St. Joseph Lead.....	New York	44½	43	43½	De. 10, De. 21 Q Ex. 1.50

ZINC					
Am. Z. I. & S.....	New York	8½	7½	7½	May, 1920 1.00
Am. Z. I. & S. pfd.....	New York	31½	30½	31	Nov., 1920 1.50
Butte C. & Z.....	New York	6	5½	5½	De. 10, De. 24 0.50
Butte & Superior.....	New York	12	11½	12	Se. 18, Se. 30 0.50
Callahan Zn-I.d.....	New York	2½	1½	1½	Dec., 1920 0.50
New Jersey Zn.....	N. Y. Curb	203	196½	203	Jn. 20, Jy. 10 Ex. 2.00
United Zinc.....	N. Y. Curb			*35	
Yellow Pine.....	Los Angeles	*75	*68	*70	Se. 10, Se. 21 Q 0.04

GOLD					
Alaska Juneau.....	New York	2	1½	2	
Argonaut.....	Toronto	*22½	*19½	*21	
Barry-Hollinger.....	Toronto	*26½	*20	*26½	
Carson Hill.....	Boston	*30	*30	*30	
Consol. W. Dome L.....	Toronto	*11½	*11½	*11½	
Cresson Consol. G.....	N. Y. Curb	2½	2½	2½	Se. 30, Oct. 10 0.10
Crown Reserve.....	Toronto	*19½	*17	*19	Jan. 1917 0.05
Dome Mines.....	New York	14½	14½	14½	Se. 30, Oct. 20, Q 0.50
Golden Cycle.....	Colo. Springs			1.51	Dec. 11, 1924 0.03
Hollinger Consol.....	Toronto	15.65	15.50	15.60	Oct. 19, Nov. 4 0.08
Homestake Mining.....	New York	49	48½	48½	Oct. 20, Oct. 26 M 0.50
Kirkland Lake.....	Toronto	*38½	*35½	*37½	
Lake Shore.....	Toronto	8.04	7.95	8.00	Se. 1, Se. 15 0.05
McIntyre-Porcupine.....	New York	19½	19½	19½	Aug. 1, Sept. 1 0.25
Newray.....	Toronto	*23	*22	*22½	
Night Hawk Pen.....	Toronto	*8	*8	*8	
Portland.....	Colo. Springs			*43	Oct., 1920 0.01
Rand Mines.....	New York	37½	36½	36½	Au. 17, Au. 25 1.52
Teck-FHughes.....	Toronto	1.98	1.93	1.97	
Tom Reed.....	Los Angeles	*55	*40	*50	Dec., 1919 0.02
Tough-Oakes.....	Toronto	*54	*48½	*53½	
United Eastern.....	N. Y. Curb	*52	*51	*51	July, 1924 0.05
Wipond Cons.....	Toronto	1.09	1.04	1.08	
Wright-Hargreaves.....	Toronto	6.25	6.15	6.22	Se. 15, Oct. 1 Q Ex. 0.5

GOLD AND SILVER					
Black Oak.....	N. Y. Curb			*81	
Con. Cortez.....	N. Y. Curb		*8	*8	
Con. Virginia.....	San Francisco	4½	3½	4½	
Continental Mines.....	N. Y. Curb			1	
Dolores Esperanza.....	N. Y. Curb	*50	*50	*50	July, 1923 0.05
Premier Gold.....	N. Y. Curb	2½	2½	2½	Se. 18, Oct. 3 0.08
Tonopah Belmont.....	N. Y. Curb	*75	*70	*70	Sep. 15, Oct. 1, 0.05
Tonopah Divide.....	N. Y. Curb			*23	Oct., 1923 0.10
Tonopah Extension.....	N. Y. Curb	1½	1½	1½	Mh. 11, Ap. 1, Q 0.05
Tonopah Mining.....	N. Y. Curb	4½	4½	4½	Se. 30, Oct. 21, 0.07½
Unity Gold.....	N. Y. Curb	*50	*50	*50	
West End Consol.....	N. Y. Curb			*30	Mar., 1923 0.05
Yukon Gold.....	N. Y. Curb			*30	June, 1918 0.02

Stock	Exch.	High	Low	Last	Last Div.
SILVER					
Alvarado.....	Boston Curb	†1	†25		Oct. 1920 0.50
Beaver Consol.....	Toronto	*29½	*28½	*29½	May, 1920 0.03
Castle-Trethewey.....	Toronto	1.30	1.24	1.28	
Conagias.....	Toronto	1.94	1.75	1.90	May, 1924 0.12½
Keeley.....	Toronto	1.54	1.45	1.53	Au. 31, Se. 15 R X 0.12
Kurr Lake.....	N. Y. Curb	1½	1½	1½	Oct. 1, Oct. 15 Q 0.12½
La Rose.....	Toronto	*44½	*43	*44½	Apr., 1922 0.10½
Lorain Trout Lake.....	Toronto			*90	Jy. 2, Jy. 15 0.05
McKinney-Dar-Sav.....	Toronto	*17	*16½	*16½	Oct., 1920 0.03
Mining Corp. Can.....	Toronto	2.94	2.70	2.92	Jy. 1, Jy. 15 0.12½
Nipissing.....	N. Y. Curb	6	4½	5½	Se. 30, Oct. 20, Q 0.15
Ontario Silver.....	New York	10½	9½	10½	Jan., 1919 0.50
Temiskaming.....	Toronto	*17	*17	*17	Jan., 1920 0.40

SILVER-LEAD					
Ahumada.....	New York	10½	9½	9½	Se. 19, Oct. 2, O Ex 0.25
Bingham Mines.....	Boston	56½	53	55	Se. 19, Se. 30 Q 0.50
Cliff M. & M.....	Salt Lake	*65	*63	*65	De. 16, No. 18 0.10
Chief Consol.....	Salt Lake	3.00	3.00	3.00	Oct. 10, No. 1 0.10
Columbus Rexall.....	Salt Lake	*4	*3	*3	Aug., 1922 0.05
Emucion.....	Boston Curb	2½	2½	2½	Se. 19, Oct. 2, Q Ex 0.15
Federal M. & S.....	New York	23	20½	23	Fe. 26, Mh. 15 Q 1.75
Federal M. & S. pfd.....	New York	69½	61½	69½	Au. 25, Se. 15, 1.75
Hecla Mining.....	N. Y. Curb	17½	16½	16½	Au. 15, Se. 15 Q 0.50
Iron Blossom Con.....	Salt Lake			*39	Oct. 25, Se. 15, Q 0.01½
Iron King Mining.....	Salt Lake	*61	*61	*61	
Keystone Mining.....	Salt Lake	*73	*70	*70	Au. 12, Au. 26 0.07½
Lucky Jim.....	Spokane	13½	13	13	
Mammoth Mining.....	Salt Lake	3.10	1.97½	1.97½	Mv. 15 Mv. 25 0.10
Marsh Mines.....	Spokane	*8½	*8	*8	Se. 15, Oct. 1 0.15
Park Utah.....	Salt Lake	8.05	7.45	8.00	Se. 15, Oct. 1 0.15
Prince Consol.....	Salt Lake			*30	
Silver King Coal.....	Salt Lake	9.35	9.25	9.25	Se. 20, Oct. 1, Q 0.25
Silversmith.....	Spokane	*26	*24½	*25½	Oct. 1, Oct. 10 0.01
Tamarack-Custer.....	Spokane	*42	*32	*38	Sept., 1924 0.25
Tintic Standard.....	Salt Lake	13.75	13.62½	13.75	Se. 22, Se. 29 0.40
Utah-Apex.....	Boston	6½	6½	6½	Oct. 3, Oct. 15, Q 0.35
Western Utah Copper	N. Y. Curb			*10	

IRON					
Bethlehem Steel.....	New York	41½	39½	40½	July, 1924 1.25
Colorado Fuel & Iron	New York	39½	38½	38½	May, 1921 0.75
Gt. North'n Iron Ore	New York	32½	30½	31	Ap. 11, Ap. 30 1.00
Inland Steel.....	New York			43	Au. 14 Sep. 1, Q 0.62½
Meabi Iron.....	N. Y. Curb	2	2	2	
Replogle Steel.....	New York	16	14½	15½	
Republic I. & S.....	New York	52½	49½	49½	May, 1921 1.50
Republic I. & S. pfd.....	New York	92½	92	92	Se. 15, Oct. 1, Q 1.75
Sloss-Sheffield S. & I.	New York	109½	101½	107½	Se. 10, Se. 21 Q 1.50
Sloss-Shef. S. & I. pfd.....	New York			98	Se. 21, Oct. 1, Q 1.75
U. S. Steel.....	New York	124½	120½	123½	Au. 29, Au. 31, Q Ex 1.75
U. S. Steel pfd.....	New York	125	124½	124½	Aug. 3, Aug. 29, Q 1.75
Virginia I. C. & C.....	New York			37	Jan., 1924 1.50
Virginia I. C. & C. pfd.....	New York			70	Jn. 20, Jy. 2, 2.50

VANADIUM					
Vanadium Corp.....	New York	30½	28½	30½	Aug. 1, Aug. 15 0.50

ASBESTOS					
Asbestos Corp.....	Montreal	94½	89	92½	Se. 3, Oct. 15 Q 1.50
Asbestos Corp., pfd.....	Montreal	112	110	111½	Se. 30, Oct. 15, Q 1.50

SULPHUR					
Freeport Texas.....	New York	24½	19½	24	Nov., 1919 1.00
Texas Gulf.....	New York	116½	111½	114½	Au. 31, Se. 15, Q 2.00

DIAMONDS					
De Beers Consol.....	New York	25½	25	25½	Jy. 27, Au. 30 0.97

PLATINUM					
So. Am. Gold & P.....	N. Y. Curb	3	2½	3	

MINING, SMELTING, REFINING AND GENERAL					
Amer. Metal.....	New York	51½	50½		