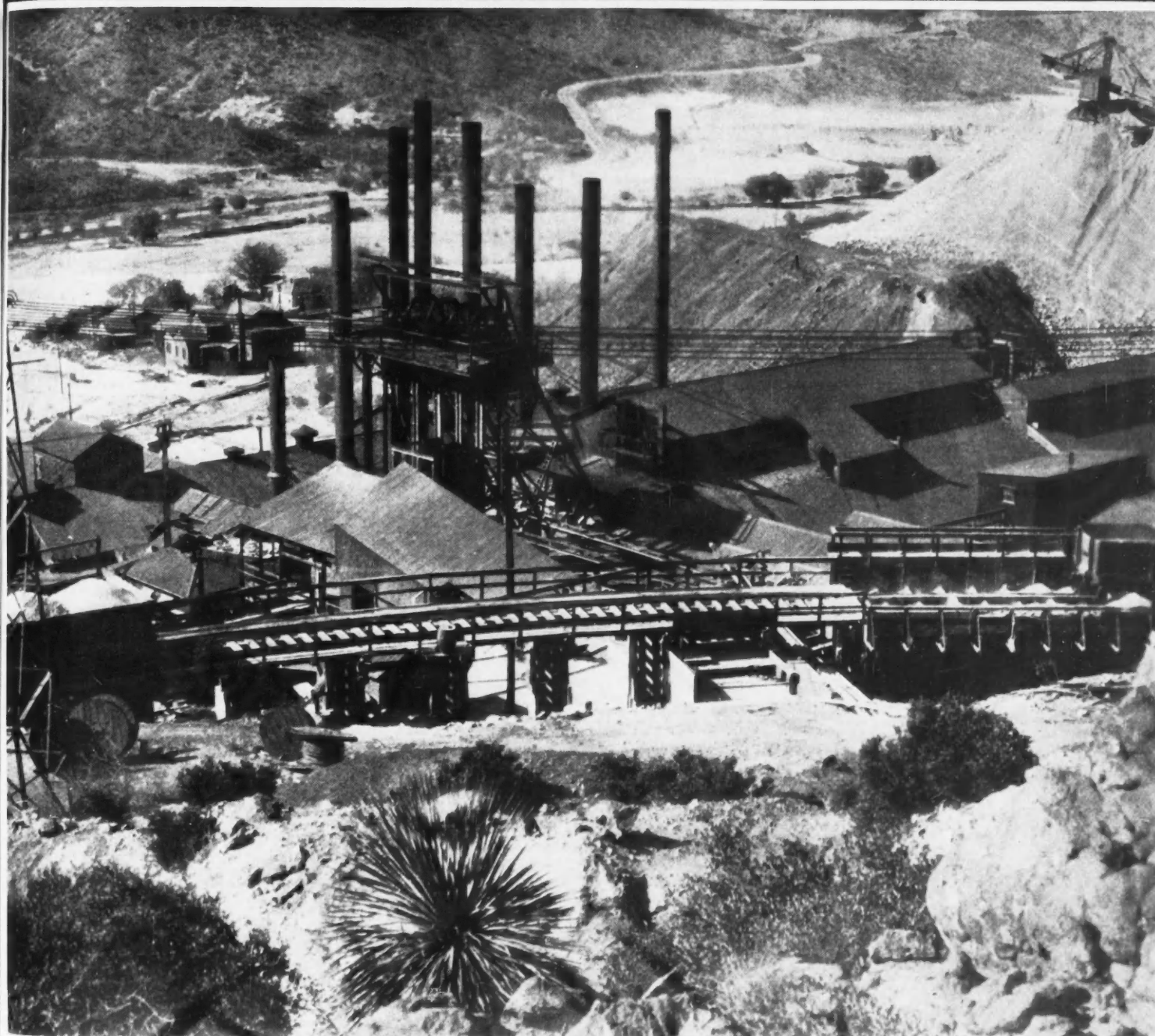


ENGINEERING AND MINING JOURNAL-PRESS

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Part of the plant of the Old Dominion Copper Mining & Smelting Co.—
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The Electrical Features of Inspiration's New Porphyry Hoists

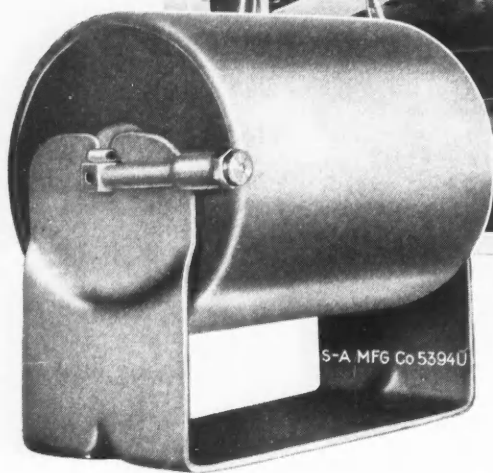
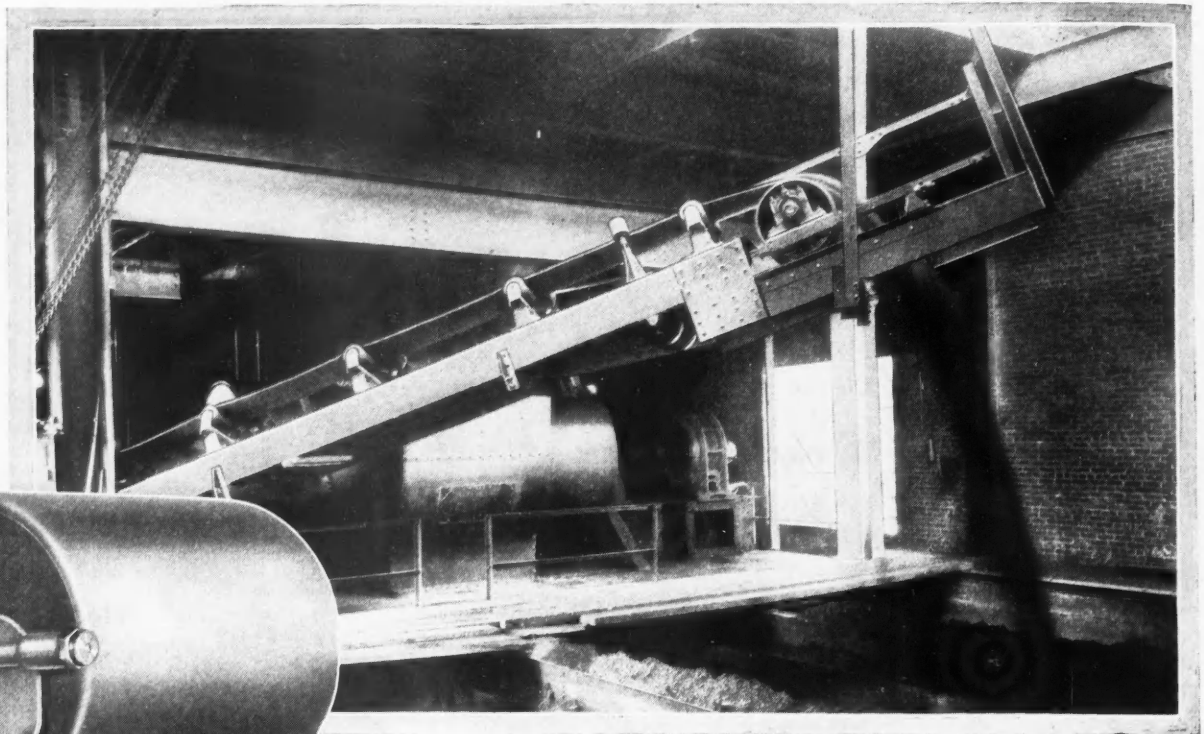
By F. R. Grant

Recent Developments in Open-pit Mining

By Robert Marsh, Jr.

Some Mineral Resources of Portugal

By K. S. Twitchell



Insuring Minimum Cost per Year of Service

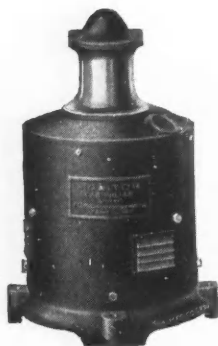
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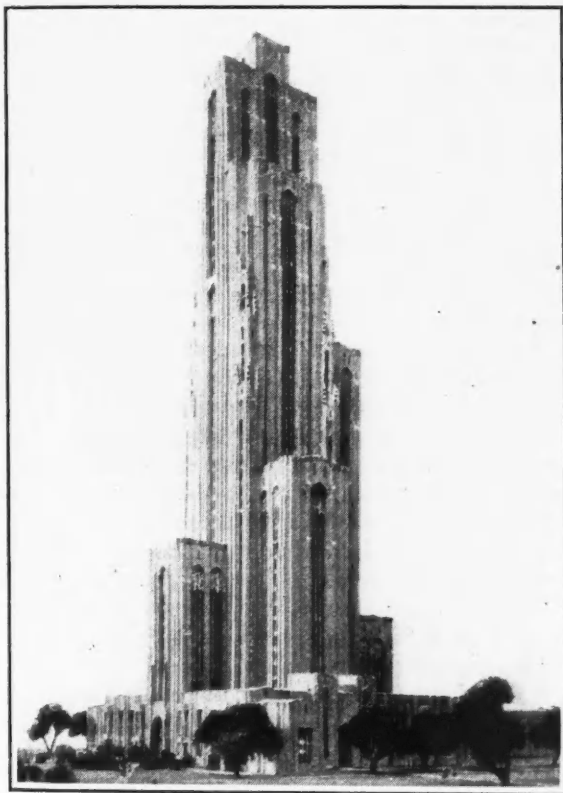
ENGINEERING AND MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

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Number 16



The Higher Education

THE PLAN for housing the University of Pittsburgh is so novel that we reproduce herewith the appearance of the University Building when completed. The building as shown will be fifty-two stories high, reaching an altitude of 680 ft. At its base it will be 260 ft. each way. This structure, together with the present permanent buildings of the university, will provide classrooms, libraries, shops, laboratories, and recreation centers for 12,000 students.

The first impression we get from the picture is the astonishing beauty of the plan—it recalls some such vision as that of the “topless towers of Ilium.” It is stated to be Gothic, but, with apologies to the architect, that designation is to be questioned. It is essentially Neo-American—a modification of the New York skyscraper, the most effectively beautiful modification yet achieved, though New York has now several architectural triumphs to its credit in this most modern type of building. The true Gothic architecture found its inspiration in the forest; the skyscraper, or Neo-American art, is the spirit of the great cliffs and the canyons.

From the standpoint of a great center of learning, no doubt the able men who are responsible for the plan have thought it out carefully and are right. Nevertheless, with the evident advantages there will be disadvantages, which the supporters have not pointed out, and which we will not take space to enumerate. The Pittsburgh University building is the logical out-

growth of the ultra-modern city; but we still have, thank God, the country; and the country university architecture, so much more classic and so much more pleasant, will survive.

We headed this serious editorial with a mild witticism, and will close with another: “Consider,” said a New York newspaper paragrapher, “the sad plight of a student dropped from this university.”

The Tariff and Other Levies

THE TARIFF on the importation of foreign goods into the United States has, as is well known, two functions. One is to raise money for the cost of government; and the other is, by varied and discriminatory rates, by putting high duties on some things and letting others in free, to help the economic position of the United States. American industries are thus (in theory) protected against too severe competition from similar industries abroad; while materials which are needed in the United States, and which we do not produce in quantity, may enter free. There are exceptions and invasions of these principles, but, nevertheless, they are the bases. In effect, the tariff is a discriminatory tax, for revenue and for promoting the prosperity of industries that need protection; it is a tax levied at our frontiers on imports.

The proceeds from this tax are not enough to run the government, so we have a variety of internal taxes—federal, state, county, and municipal. Some of these internal taxes are also discriminatory—there are special taxes on tobacco and other luxuries; also on iron mines in Minnesota. The first is based on the theory that a tax may be paid on luxuries without interfering with economic prosperity; the second is socialistic, on the theory that the ore deposits belong to the state; and, since they are being exhausted by being worked, the special tax is exacted by way of a depletion fund for the state.

The various mining industries are among those American industries which should receive the thoughtful and favorable care of the government, to a greater extent than they have had it heretofore. The protection of a preferential tariff in varying degrees has been extended to many mineral industries, such as lead, zinc, manganese, magnesite, and many others. Some of these tariffs have effectively fostered the industries for whose benefit they were imposed; others have proved ineffective, for various reasons. But there are many industries, mining and others, which cannot be fostered by the tariff. Industries producing commodities of which we have an exportable surplus, like copper and zinc, cannot maintain the tariff differential, or, indeed, any differential, from the world price in the price of their products. The tariff on wheat and other farm products proved a dead letter for the same reason; and the farmer and his many friends are now seeking franti-

cally for some other form of economic assistance and preferential treatment.

Under these circumstances, if the discriminatory tariff tax fails to help, why not a graded discrimination in internal taxes? This would give the desired assistance, and would be no different in principle, and would work no greater hardship against the unfavored, than the discriminating frontier tax. We recommend this idea to the copper producers as a more practical one than a tariff on copper.

Finally, there is the American gold industry—a valuable and essential one, which is clearly and definitely on the down grade. Yet the federal, state, and municipal governments continue to tax the industry with unrelenting zeal. If the industry is worth saving, why not use reasonable moderation in the blood-letting? When the mine is closed, the taxes will be less; a system of discriminating taxes might keep the mine running and still yielding more to the cost of government than a dead mine could do.

Geological Miracles

MAKING GEOLOGY CLEAR to the public was the endeavor of Mr. E. C. Andrews, government geologist for New South Wales, in a lecture given at the Mining Museum at Sydney recently. He described in simple and graphic language the stupendous geological history of the great Broken Hill Lode:

"Can you imagine an observer watching through the geological ages? He is immortal, but, unlike poor old Tithonus of the fable, he is not affected by the passage of the ages; like Byron's Ocean, 'Time writes no wrinkle on his placid brow.' Hundreds of millions of years go by; yet he records the changing events dispassionately. He takes up his position long before the dawn of life on the earth, and he maintains his vigil until the present day.

"Away in the dim and shadowy past, he would have seen the Broken Hill acre occupied by a sea or lake with sinking floor bordered by high ranges. As the sinking progressed the sea trough became filled with many thousand of feet of mudstone, sand, and gritty layers. This floor sank until its load of sediments became too great for its strength. Then the floor of the sea collapsed and crushed on itself. The surface rose to form a mighty range like the Himalaya and within this disturbed mass the Great Broken Hill Lode itself was formed.

"As a final stage in this period of storm and stress, certain fire rocks, as gases or other mobile form, arose, and these were associated with vast quantities of lead, silver, zinc, and sulphur, together with cadmium, iron, manganese, silica, copper, and other minerals.

"One could not have failed to have been intensely interested in the manner in which these gases or vapors traveled, nor with the peculiar traps which seemed to have been set to catch them. The vapors seemed to sweat, as it were, along great planes or zones of weakness, forcing apart the bedding planes and forming large lenses or 'eyes,' leaving little or no trace of their passage, or else being caught in weak, broken folds alongside with impervious slate caps as shown in the sections. In these folds they formed pressure lenses in part by reason of the gigantic head under which they rose, but mainly by replacement, bit by bit, of the solid but strained sandstone and mudstone beds. The sections taken across the Main Broken Hill Lode illustrate this well. These forms, although at the surface today, were formed in the deep core of the mountain range.

"Though the mills of God grind slowly, yet they grind exceeding small,' and our observer would have seen the great mountain chain denuded slowly and its very core exposed to the day, the lodes of Broken Hill being laid bare.

"Then would the observer have seen a strange thing. This old range which had received its baptism of fire, which had continually risen and been worn down, now began to sink, and as it sank the climate of the district changed to an Arctic one. Our observer would have needed Arctic cloth-

ing, and that for a vast period too. Great ice masses were formed and passed over the region. They were dragged over the Broken Hill lodes, and our watcher would have seen large fragments of the lodes torn off, and carried away to form newer layers over the sinking area. Vast as was the period which separated this Arctic Period from the formation of the Broken Hill lodes, it was nevertheless prior to the oldest fossils known in Australia.

"This area which had passed through such storm and stress was henceforth to become one of the stable blocks of the earth's surface. It had passed through its deluge of fire and emerged triumphant, much as the plastic iron, which apparently is so weak in the furnace, passes thence to form the tempered steel. Our observer would have seen other parts of New South Wales and Australia lying farther east, which passed later through great periods of stress and strain, but Broken Hill remained serene and unmoved through all these panics.

"Nevertheless, quite late in geological time, the old stable mass broke along a great north and south line. The portion containing the Broken Hill Lode rose, while the other sagged and in turn became alluviated, such that the plain now sweeps against the dismantled scarp of the uplift much as the plane of the sea ends abruptly against a bold and dissected coast."

A spectacular story: nevertheless a true and simple rendering of the geologist's conclusions, which Mr. Andrews has elsewhere put into a weighty volume, solemn and involved enough for the primmest of pedagogues. Geology is a romantic and spectacular story: it is the wildest of "movie" pageants, if really visualized. Photography and cinematography show us a rose budding, blooming, and dying in a minute. The camera has patiently caught the rose at each stage of its development: and then the picture has been run off rapidly. In the same way, it has occurred to us, a photograph taken of the front of a glacier each six months for a number of years, and then run through the cinematoscope rapidly, would show the ice sweeping along like an unchained flood. And if a photograph were taken every hundred years of an average shore front, for some thousands of years, and the same method were applied, we should see before our astonished vision cliffs rising, or foundering—or mountains crumbling like sand before the attack of the seas, or rocks buckling and breaking before our eyes. All this goes too far to be practicable, although in the realm of the thinkable: and maybe some ingenious geologist-photographer will yet give us strange demonstrations along these lines. Meanwhile, the miracle of rapid reconstruction must be done with words.

Copper Prices and Economic Laws

THE WORLD'S COPPER PRODUCTION exceeds its consumption, at the present time, by 200,000,000 lb. a year, according to a British authority who recently visited in New York, and an anonymous producer, quoted in the *Wall Street Journal*, argues that if consumption had been exceeding production for the last year, the price of copper would have been at least two cents higher; that this excess production costs the companies at least \$46,000,000 a year, whereas a cut of 200,000,000 lb. in the annual production would result in little loss to producers, probably \$4,000,000 annually.

Certainly, no one can complain that these figures are not sufficiently precise. As to their accuracy, that is another matter; we question especially that production has recently been so far beyond consumption. At the end of the first quarter of 1925, American producers' stocks of refined copper were only 6,000,000 lb. greater

than a year before, and there is no reason to think that consumers' stocks and stocks in other parts of the world are much if any greater than a year ago.

But it may be very true that if production were cut, producers would be better off. Likewise, if the farmers of the world cut their wheat production from three billion bushels a year to two and a half billion bushels, they would probably all be better off; and if all the manufacturers of lead pencils reduced their output one-quarter, they might be able to sell them for twice as much and thus be more prosperous. The same reasoning applies to most any commodity that has earned a place for itself in industry that cannot readily be filled by a substitute. Fortunately for the consumers, however, the producers have no such arbitrary control of the prices of their product. Too many new producers would immediately enter so prosperous a field. The fundamentals of economics cannot thus be ruthlessly flouted. The price of copper is where it is because producers find it profitable to mine enough copper at present prices to supply the demand. Those who produced the 1,500,000 tons of copper that was sold in the world last year did not go into bankruptcy in doing it; they paid dividends and they are paying dividends now. Those companies whose costs do not allow them to produce copper at a profit at present prices are simply out of luck for the time being and will so continue until demand increases beyond the capacity of the present producers.

Assessable Mining Stock

THE RECENT RULING of the New York Curb Association against the listing of assessable stocks is of interest to mining companies. Mining companies whose stock was assessable were once very common; but in many cases the system was abused by those who held control of the company's policy, and the situation degenerated into what was plainly called by them a game of "freeze-out." Every time a new assessment was declared, a certain margin of discouraged stockholders refused to pay, and thereby forfeited their stock, which made the shares of those who were still in so much more valuable. But at the next assessment another outside ring of clinging stockholders was jarred loose, while the real insiders fattened thereby. Meanwhile, the stock was judiciously traded in and maneuvered on the stock exchange, new buyers came along, speculating, buying for a rise, and thereby a new crop of stakers was ready for the assessment.

In some cases mines were kept open and run for many years by systematic assessments, these paying for the salaries of the controlling ring and for the deficits in mining operations. These were losing enterprises, which on a strict business basis would have been shut down. Some of the companies operating on the Comstock Lode are examples. The investor who hopes to make money out of mining profits—if there be any so guileless—had about the same chances as the traditional snowball in Hades.

The plan of operation was indeed like those Tontine associations which had a tremendous vogue some thirty years ago. You joined an association whose whole business was to get members who would pay into the association heavy dues. Once in so often the "pot" was opened, and the contents of the treasury were distributed to the members in good standing. It was

stated as a sound psychological principle that a certain number of members would constantly drop out, for various reasons, principally the inability to keep up the financial strain, forfeiting what they had already paid in. The stayers would therefore receive an enormous interest on their investment. The associations disappeared as quickly as they came: decease partly came from natural reasons, partly because the schemes were declared unlawful.

Such practices as we have sketched above were perhaps the exception; but they were common enough to call for the non-assessable stock plan, which would guarantee the investor at least a certain non-forfeitable equity in consideration of money invested. This equity may be and often is a vanishing one, in the hands of skilled jugglers of corporations; nevertheless, it does not disappear with the disconcerting suddenness and thoroughness of the equity represented by assessable stock. And by the process of evolution—because people would not buy assessable stock—the promoter has turned almost entirely to non-assessable stocks.

On the other hand, it is easy to see that in certain conditions and in the hands of the right people the assessable stock has advantages. If a group of people with their eyes open go into a mining enterprise with the intention of staying with it to the end, and with their eyes open agreeing to assessments *ad libitum*, then the problem of continued capital for continued operations is an easy one; and those financial crises, so ruinous to the stockholders' interests, which so often afflict the non-assessable mining stock, are avoided. Moreover, the financial history of many mining companies has shown that assessable mining stocks have been the basis of numerous successful ventures after one or more assessments. The great Homestake mine, in South Dakota, levied one assessment before it became a profitable gold producer; the Tintic Standard mine, in Utah, levied not fewer than nineteen assessments before it, too, went over the top.

The purchase of non-assessable stock is no more protection to the investor against fraud than a purchase of the assessable variety. Both may be manipulated before and after they are issued. In the last analysis the honesty and reputation of the people behind the company is the best guarantee the stockholder can have.

Gold in Mono Lake

THE *Nevada State Journal*, in an interview given by Walter Techau, reports that "Some prospecting is going on near Mono Lake, but the attempts to recover gold from its waters seem to have been abandoned, not so much for the reason that gold in sufficient quantities was absent but on account of the difficulties in recovering it."

The alleged gold in the waters of Mono Lake was miraculously changed to platinum and iridium, and now, presto! it is changed back to gold. Mono Lake is like unto the old-time alchemist but slightly more successful—soda into gold, gold into platinum and iridium, and then platinum and iridium back to gold! Perhaps the gold will be again transmuted back to soda, and the dreams of truckloads of gold scurrying out to Minden and loading their precious burden upon the V. & T. at Carson will be dissipated in the dry desert air that edges upon the snowclad peaks of the Sierras on the western shore of this beautiful lake.

Mine Executives of Note

Eugene Burford Braden

CUSTOM SMELTER WORK and precious-metal refining, as a successful commercial venture, are dependent necessarily upon business ability assisted by competent technical control. The business features must be managed with tact, patience, and due consideration of the demands of the enterprise. Accuracy in metallurgical accounting is essential, usually only equaled at the Mint. It was therefore appropriate that E. B. Braden, who has just retired after twenty years' service at the Selby Smelting Works, should have been graduated, as it were, from a United States assay office. The subject of our biography was born at Indianapolis, Ind., on May 12, 1864. His ancestors were American for several generations, descended from English and North-Irish forbears. Education was received at Indianapolis, after which he was associated with various railroad companies in a clerical capacity, becoming general agent of the St. Paul & Minneapolis & Manitoba in San Francisco in 1889. A year later he joined his brother Spruille Braden in the business of mining and ore

sampling at Helena, Mont.; later, he was associated with William Braden, another brother. In 1894 he was appointed in charge of the U. S. Assay Office at Helena, Mont., where his work included extensive contributions to the annual reports of the Director of the Mint, which in consequence contain much pioneer information on early mining and metallurgy in Montana. The American Smelting & Refining Co. was organized in 1899, and Mr. Braden was appointed its agent at Spokane, Wash., being transferred to East Helena, Mont., in 1902 and appointed manager of the plant there. In 1903 he combined with these duties that of manager of the Everett smelter. In 1905 he was sent to San Francisco to take charge of operations of the Selby Smelting & Lead Co., of which he was vice-president until the local organization became a recognized branch of A. S. & R. activities, in 1918, when he became general manager. Mr. Braden held a responsible position of historical interest. Thomas Selby, the "father" of the enterprise, operated a shot

tower in 1864. We have before us a book of tables of gold and silver fineness, published in 1867 for the San Francisco Assaying & Refining Works. At 416 Montgomery St., its place of business, it is probable that the slugs of gold, common at that period, were cast from

metal refined on the premises. This business was absorbed by the Selby Smelting & Lead Co. in 1874. Later, acquisition by the A. S. & R. occurred in 1905. The Selby smelter now handles ore, concentrate and base bullion from Alaska, the Philippines, Bolivia, Java, Mexico, Chile, Peru, Canada, San Salvador, and Nicaragua, as well as from domestic sources. It has refined as much as 4,500,000 oz. of silver and 300,000 oz. of gold in one month; it treated what was probably the richest carload of gold ore ever produced, from Goldfield, Nev., a check for \$537,000 representing payment for forty-eight tons. The history of mining in the United States indicates that custom smelters have filled a definite requirement. That they should be in the hands of financially responsible parties is generally understood. An instance is recalled of early



EUGENE B. BRADEN

smelter history in Montana: A car of ore was bought and paid for on the basis of current silver quotations, but before it reached the smelter the value had decreased by \$3,500. Today, however, the business is systematized to inhibit risks of such a nature. Silver as metal is sold as soon as silver in ore is bought. As an example of accuracy in Selby control work, the comparative estimates by mine and smelter of ore and concentrate from one property in recent years that has produced 8,899,000 oz. of silver and 24,448 oz. of gold varied by no more than 8c. in gold and 0.01 oz. in silver, per ton. The Presidio Mining Co. of Marfa, Mexico, has been a client of the Selby smelter for more than forty years!

Custom milling or smelting is a business, not a charitable enterprise; between seller and buyer an agreement is made, and we have no hesitation in saying that E. B. Braden is of a type who sees that such an agreement is kept and that the interests of his company are safeguarded.

Electrical Features of Inspiration's New Porphyry Hoists

Automatic Control of Ore-hoisting Equipment and Many Safety Devices Notable

By F. R. Grant

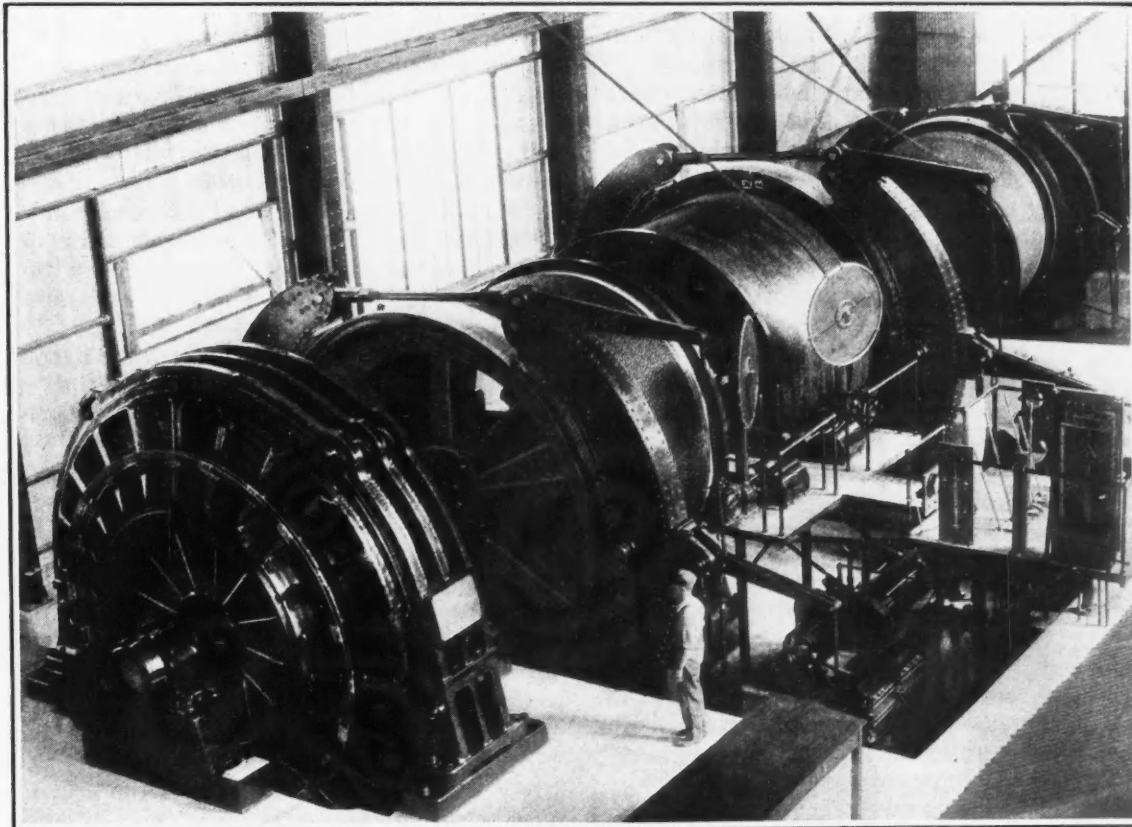
Industrial Engineering Department, General Electric Co.,
Schenectady, N. Y.

THE TWO HOIST EQUIPMENTS described in this article are installed at the Porphyry shaft section of the Inspiration Consolidated Copper Co., at Inspiration, Ariz. This is a new shaft, sunk to provide an outlet for the large orebody known as Live Oak No. 2, and has been described in two articles, one published in *Mining Journal-Press* on Feb. 10, 1923, and the other, in *Mining Journal-Press* of March 21, 1925.¹

The hoisting equipment consists of two complete units, one for handling ore and the other for handling men and material. The ore hoist is of the balanced type; the other is of the counterweighted type. Ore is raised in skips holding approximately twelve and one-half tons each; men and material are handled on a cage holding fifty-six men—or a five-ton mine car if waste is being hoisted. The electrical equipment of

Inspiration company was guided largely by its experience with equipment already in use. It has had in operation at its main shaft for the last ten years two automatic hoists of the Ilgner-Ward Leonard type, which were described in a paper by H. Kenyon Burch and M. A. Whiting, presented at the Arizona meeting of the A. I. M. E. in September, 1916. These hoists have given remarkably good service and have proved an efficient, economical, and reliable unit. When the new equipment was considered, it was therefore decided that the ore hoist should be of the automatic type, precluding the necessity of the services of hoisting engineers, and that the man and material hoist was to incorporate certain safety and protective features which will be described later.

The ore-hoist motor is of the d.c. type, rated 2,150 hp., 51 r.p.m., 650 volts, and is direct-connected to the



Inspiration's new automatic electrically operated ore hoist recently installed at Porphyry shaft. It handles two 12-ton skips in balance, raising 600 tons per hour. Beyond it is the man hoist

both hoists was furnished by the General Electric Co., and the hoist drums and mechanical parts were made by the Nordberg Manufacturing Co.

In selecting the type of hoists to be installed, the

hoist drums. A motor generator consisting of a 1,600 kw., 500 r.p.m., 650-volt, d.c. generator; a 1,900 hp., 500 r.p.m., 6,600-volt, 3-phase, 25-cycle, phase wound induction-motor, and a steel-plate flywheel weighing 78,000 lb., supplies power to the hoist motor. The control equipment consists of a slip-regulator for the

¹Additional photographs of the hoists will be found in the issue of March 21, 1925.—EDITOR.

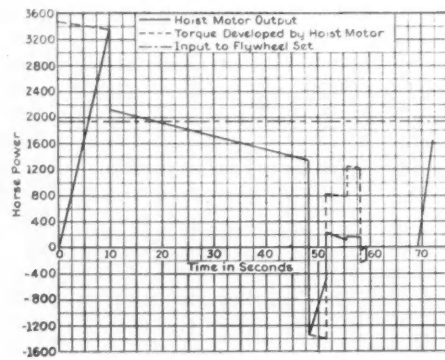


Fig. 1

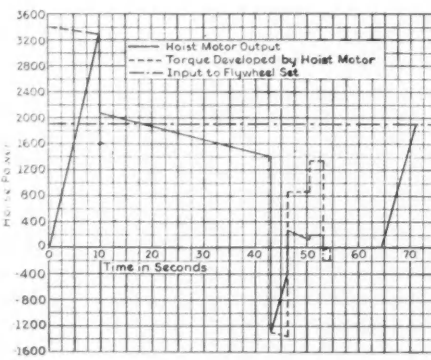


Fig. 2

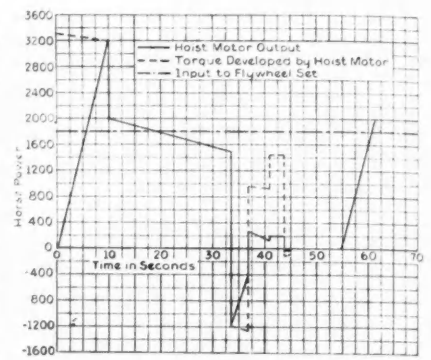


Fig. 3

Fig. 1—Theoretical duty cycle curve of ore hoist for balanced hoisting from 1,485 level. Fig. 2—Theoretical duty cycle curve of ore hoist for balanced hoisting from the 1,330 level. Fig. 3—Theoretical duty cycle curve of ore hoist for balanced hoisting from 1,025 level

induction motor of the flywheel set, together with a suitable drum-controller and a resistance and other auxiliary control for the generator field. The equipment operates on the well-known Ilgner-Ward Leonard system, wherein the speed and direction of rotation of the hoist motor are governed by the generator field and the power input from the transmission line is limited to a certain predetermined amount by means of the slip regulator and flywheel. Excitation for the generator, the hoist motor, and the control devices is furnished by a separate motor-driven exciter rated 75 kw., 250 volts.

The equipment was laid out to hoist from three different levels in the mine, and in this respect it is different from any other automatic hoist now in operation. It is also worthy of note that the hoist motor is, in point of physical size, the largest single mine-hoist motor ever built. Provision is made for automatically loading the skips with a definite amount of ore per trip and for automatically dumping them at the top.

The data from which the capacity of the equipment was calculated are as follows:

Inclination of shaft to horizontal, degrees.....	90
Total lift:	
From upper level, feet.....	1,025
From intermediate level, feet.....	1,330
From bottom level, feet.....	1,485
Assumed rope travel with skip in dumping horns, feet.....	41
Weight of material per trip, pounds.....	24,000
Weight of skip, pounds.....	21,000
Size of rope, diameter, inches.....	1 1/2
Weight of rope per foot, pounds.....	5.55
Type of drums, double cylindrical. (One drum fixed, the other clutched).	
Drum diameter, feet.....	12
Effective weight of drums, sheaves and other rotating parts, except motor armature, brought to rope center (assumed): pounds.....	121,000
Assumed mechanical efficiency of the hoist parts, per cent.....	80
(Mechanical efficiency includes all losses between hoist-motor coupling and material hoisted).	

The equipment was designed for an output of 10,000 tons of ore in sixteen hours when operating from the 1,485 level. From these data the following hoisting performance was determined:

	Levels, Feet		
	1,025	1,330	1,485
Maximum rope speed, feet per minute.....	1,920	1,920	1,920
Maximum drum speed, feet per minute.....	51	51	51
Time schedule:			
Acceleration, seconds.....	10	10	10
Full speed, seconds.....	23.6	33.2	38.1
Retardation, seconds.....	11.2	11.2	11.2
Rest, seconds.....	10	10	10
Time total trip, seconds.....	54.8	64.4	69.3
Number of trips per hour.....	65	56	52
Tonnage per hour, short tons.....	780	670	625

From the foregoing data, hoisting duty cycles were calculated for each level as shown in Figs. 1, 2, and 3. The capacity of the equipment is such that, when oper-

ating under these conditions, the temperature rise of no part of the hoist motor or motor generator will exceed 40 deg. C. above a surrounding air temperature of 40 deg. C. at an elevation of 4,000 ft. above sea level. The equipment also has sufficient capacity for hoisting, in emergency cases and at reduced speed, the unbalanced loaded skip from any level.

The control is so arranged that the hoist may be started, for automatic operation, by remote control from any one of the three mine levels or from the hoist house.

When operating automatically, the drum controller is turned "on" by a pilot motor and "off" by cams. When it is desired to operate by hand, the automatic starting feature is cut out and the controller is turned "on" by the hoist operator and may be turned "off" by him, or he may let the cams turn it "off," as is done in automatic operation.

The pilot motor is a small d.c. motor and drives the controller through a magnetic clutch and train of gears. The clutch coil is connected in series with the pilot-motor armature, and so engages or releases as the pilot motor is thrown "on" or "off" the line. The turn-off cams are geared to the hoist drums and operate through a fleeting gear arrangement, so that they pick up at a definite point in the travel of the hoist and turn the controller off.

When changing from one level to another, it is necessary that the attendant in the hoist house bring the skips to the proper position and set the control for operation from the desired level. A selective switch is provided in the hoist house for transferring the remote control to any one of the three levels in the mine or to a remote control switch in the hoist house to allow for testing and adjustment.

When the hoist is adjusted for operation from any level, the loader at that level may start it by closing the master switch, after which the operation is entirely automatic until the end of the trip is reached. The hoist will accelerate at a certain predetermined rate until it reaches full speed and will then run at full speed until a certain point in its travel is reached, when it will be automatically slowed down and finally brought to rest when the loaded skip has passed through the dump. When the hoist has once been started from the loading station, it cannot be slowed down or stopped by the loader in the mine, but will continue to the end of the trip unless shut down by one of the emergency features to be explained later.

A telephone system is installed for communication between the mine and the hoist house. When it is desired to change from one level to another, or to make any other unusual movement of the hoist, the loader in the mine calls the attendant in the hoist house, who makes the necessary adjustments. While these changes are being made, the automatic control is entirely cut off, so the loader cannot interfere in any way with the hand operation of the hoist.

The control is so arranged that the loader who starts the hoist has no control over the direction in which it will move. This is done automatically by selective devices, so the hoist will always start in the right direction.

BRAKES ALWAYS IN OPERATING CONDITION

The hoist brakes are of the oil-operated type, being released by oil under pressure and set by gravity. An accumulator with electrically operated pumps assures a continuous supply of oil at 115-lb. pressure. Two sets of accumulator pumps are provided, one of which operates from the 250-volt, d.c. circuit, and the other from the low voltage, a.c. circuit.

There is a brake on each of the hoist drums, and, in ordinary operation, both brakes operate each trip. As a result, the brakes are always in operating condition and available in case of emergency. In automatic operation, the brakes are released through a solenoid-operated valve, called the service valve. The solenoid is energized at the beginning of a trip to release the brakes and is de-energized at the end of the trip to set the brakes. This solenoid valve admits oil to an auxiliary operating cylinder which is connected to the brake operating levers. Thus, the brake levers function during automatic operation just as they would were they handled by an operator. The movement of the levers operates the valves which control the brakes themselves. In cases of emergency, the brakes are applied through two emergency solenoids operating in connection with the valve mechanism direct. Normally, these solenoids are energized continuously, but should any of the emergency devices operate, the solenoids are de-energized and cause the brakes to set independently of the brake levers and irrespective of the position in which the levers may be at the time. The operation of an emergency device will also de-energize the service solenoid and so bring the brake levers to the "applied" position. This will, of course, set the brakes if, for any reason, they have not been set by the emergency solenoids.

The hoist is equipped with two Lilly controllers, one of which is geared to each drum. These controllers provide over-speed and over-travel protection and also regulate the setting of the brakes in emergency. If the emergency occurs when the skips are not near the limits of their travel, the brakes will set comparatively slowly, as there would presumably be no great amount of damage done due to a slight delay in bringing the equipment to rest. If, however, the emergency occurs when the skips are near the end of their travel and when a small amount of over-travel might result in serious damage, the brakes will set immediately and so bring the hoist to rest within the shortest possible space. This regulating action is obtained by means of cams under the emergency and service solenoid plungers, which limit their travel and so control the application of the brakes.

A typical cycle of operation is as follows: When the skip at the bottom is loaded, the attendant on the loading floor closes the starting switch to start the hoist. This energizes the pilot motor in one direction, depending on the position of two geared directional switches which determine the direction of motion of the hoist. The revolving pilot motor slowly turns the controller from the "off" to the "on" position. The first controller point to make contact is in the brake-operating circuit. This contact energizes the service solenoid which releases the brake. Next, the generator field circuit is established, giving a low voltage on the generator and a slow speed to the hoist. As the controller moves to successive points, resistance is cut out of the generator field and the generator voltage and motor speed are increased until the hoist is running at full speed. On the last controller point, the pilot motor circuit is broken, thus stopping the controller and disconnecting the pilot motor from it. The pilot motor circuit cannot be re-established until the controller is brought to the "off" position and the starting switch closed.

After the controller has reached its full "on" position, the hoist continues to run at full speed until a certain point in the travel is reached, when it must begin to slow down. Two methods are employed for this purpose, one consisting of two geared slow-down switches and the other of two cams geared to the hoist drums. Each geared switch is equipped with two contacts, each of which controls two contactors. The switches are so adjusted that they open their contacts just before the cams begin to turn the controller off, thus giving a continuous slowing down effect. The contacts open in sequence, giving two slow-down points, before the cams pick up. Opening the contactors inserts resistance into the generator field circuit and begins slowing down the hoist. The cams then begin turning the controller off, and additional resistance is thus inserted into the generator field. Finally, the field circuit is broken when the controller reaches the "off" position and the hoist comes to rest.

At the beginning of the next trip, the geared directional switches will have reversed their position, and

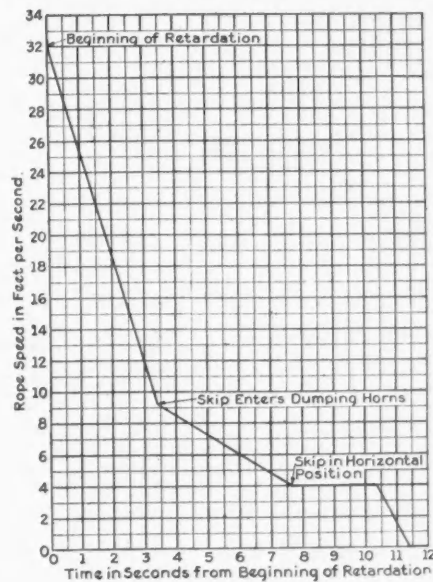


Fig. 4—Theoretical retardation curve of ore hoist, showing change in rope speed while the hoist is being brought to rest

the pilot motor will be energized in the opposite direction, giving the reverse direction of rotation to the hoist. The same sequence of events is then repeated.

In operation, it was found advisable to lengthen somewhat the acceleration and retardation periods, thus allowing the skips to travel slower through the dumping horns, reducing wear and tear on the skips and the guides. The final adjustment gave 15 seconds for acceleration and approximately the same for retardation. A complete trip from start to stop is made in about seventy seconds, and about five seconds is required for loading, a trip thus being completed every seventy-five seconds.

Experience obtained with the two original equipments shows that it is essential to reduce the rope speed to a comparatively low value when the skips enter the dumping horns. Therefore, during the first part of the retardation period, the speed is reduced very rapidly from 32 ft. per second to about 6 ft. per second, at the time the skips enter the horns. The retardation rate is then decreased while the skip is passing through the horns, until it is in approximately a horizontal position, when the speed is about 2 ft. per second, and it continues at this speed for a short time until it is in the dumping position, when the hoist is suddenly stopped. Fig. 4 shows the theoretical retardation curve for which the equipment was designed, and it was found in actual practice that this curve is approached very closely except at the point where the skip enters the horns, the speed there being somewhat below that shown in the curve.

EFFECT OF HOISTING EMPTY SKIPS

Because of the fact that the speed and voltage of the motor generator vary with the load, it was found necessary to introduce a feature in the control to limit the rope speed when an empty skip is hoisted. To accomplish this, a relay and contactor are used. The relay coil is connected across the generator armature and adjusted to pick up at about 700 volts. The contactor-coil circuit is carried through the tips of the relay; thus, when the relay picks up, it opens the contactor. The contactor tips, when closed, short-circuit a block of resistance in the generator field. When the contactor opens, this block of resistance is inserted into the generator-field circuit and holds the generator voltage down to a predetermined value. When hoisting ore, the contactor remains closed, as the generator voltage never reaches the pick-up value of the relay.

Since the generator and hoist motor armatures are connected solidly together electrically, there would be a tendency for a comparatively large circulating current to flow when the hoist is at rest, caused by the residual magnetism of the generator field. To prevent this, the generator field is connected, self-excited, across the generator armature when the controller is in the "off" position, but in the opposite direction to that in which

it was last excited from the exciter. Hence any voltage generated will produce a field in the opposite direction and so tend to neutralize itself. This connection is commonly known as the "suicide" connection, due to the peculiar property the machine has of "killing" itself when this connection is made.

When the "suicide" connection is made, any voltage which the generator may be developing is suddenly decreased, resulting in a rather heavy pump back current from the motor. This constitutes a very effective braking action for bringing the equipment to rest quickly. Advantage is taken of this to stop the hoist at the end of the trip when the controller turns to the "off" position.

It was found that the overhauling effect of the unbalanced cable is much more pronounced when an empty skip is hoisted than when loaded skips are being hoisted, and it has proved advantageous to vary the braking effect of the "suicide" connection, depending on the load hoisted. This was done by introducing a resistance in the "suicide" circuit to reduce its effect when hoisting ore. This resistance, however, is short-circuited when an empty skip is sent up, thus giving the full effect of the "suicide" connection for an empty skip, but a reduced effect for a loaded skip. This arrangement worked out very successfully in operation.

While the hoist brakes are released through the controller, as explained above, it was found advisable to prevent their setting immediately when the controller was turned off, thus allowing the hoist to drift a short distance until the down-going skip rests on the loading chairs. The brake circuit is, therefore, carried through contacts on geared switches, and these are adjusted to trip just as the skips reach the loading and dumping position. This permits full advantage to be taken of the dynamic braking effect of the "suicide" connection and also prevents unnecessary wear of the mechanical brakes, as the hoist actually comes to rest before the brakes set.

MEANS FOR STOPPING FLYWHEEL GENERATOR SET

If power were cut off from the induction motor of the flywheel set, it would continue to run for about two and one-half hours because of the inertia of the flywheel. This might be very inconvenient at times should it be desired to stop the set for a short period. To overcome this, equipment is provided to stop the set quickly by "plugging" the induction motor. A double-throw oil circuit breaker in the primary circuit provides a method of reversing one phase of the motor. A grid resistor is connected in series with the slip regulator in the secondary circuit, but is normally short-circuited by a triple-pole contactor. Interlocks are making it necessary for the contactor to be open and the slip regulator in the maximum resistance position before the "plugging" switch can be closed. The grid resistance and slip regulator in series gives sufficient resistance to limit the primary current to about one and one-half times normal and this will bring the flywheel set to rest in about two and one-half minutes.

The control incorporates the usual safety features including the Lilly controllers mentioned. These provide over-speed and over-wind protection. In addition, there are track-type limit-switches installed in the headframe and actuated by the skips. These limit switches if opened give a full emergency stop by opening the circuit breaker and causing an emergency

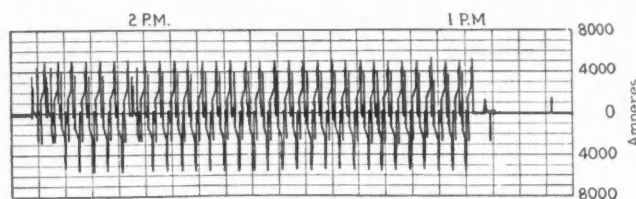


Fig. 5—Recording ammeter chart of ore hoist, showing typical period of hoisting, including two empty skips

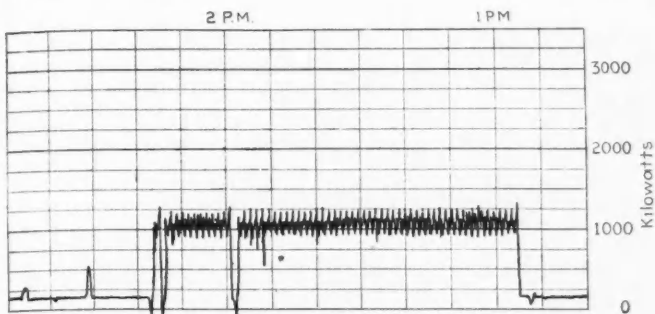


Fig. 6—Recording wattmeter chart showing input to the ore-hoist flywheel set during the same hoisting period as shown in Fig. 8

application of the brakes. Back-out switches are provided for short-circuiting these limit switches after an overwind. They allow the hoist to be started in the reverse direction, but make it impossible to start in the same direction again until the skip has first been backed out clear of the limit switch and the back-out switch then returned to the normal operating position. An emergency stop will be made under any of the following unusual circumstances:

- Loss of exciter voltage.
- Failure of alternating-current power supply to the exciter set.
- Over-speed of the motor generator.
- Opening of the direct-current circuit breaker.
- Opening of the hand emergency switch.
- Loss of the hoist motor field.
- Opening of the track limit switches.
- Operation of the Lilly controllers due to over-speed or over-travel.

After any of the emergency devices have operated and opened the circuit breaker, it is impossible again to energize the generator field until the controller is brought to the "off" position. The control equipment, therefore, will always be in the starting position when the circuit breaker is closed.

If the hoist is at rest for thirty seconds or more, a section of resistance is automatically inserted into the hoist motor field circuit, thereby reducing the heating and standby losses. This resistance is cut out at the beginning of the next trip.

Though this equipment does not include any new or novel features of fundamental operation, it did introduce several unusual conditions which have not heretofore been met in automatic hoisting. The size of equipment itself is out of the ordinary, the rope speed is higher than has ever before been handled automatically, and the depth from which the ore is hoisted is the greatest which has yet been attempted by automatic means. These conditions made it necessary to introduce several unusual features in the control and emphasize the necessity for much finer adjustment and more sensitive control than are necessary on lower-speed, shorter-lift hoists.

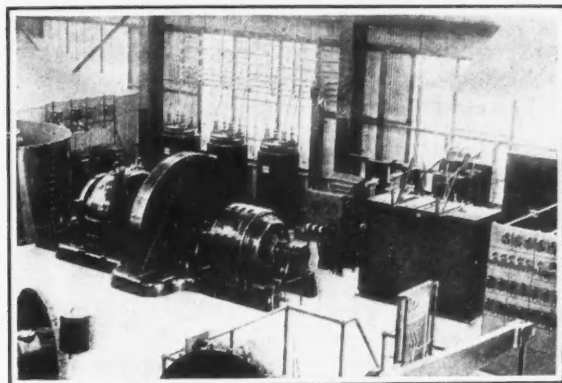
The man and material hoist operates on the same general principles as the ore hoist, except that the control is handled manually by a hoist engineer stationed on the hoist platform. The engineer releases the brake and moves the controller by means of levers. This equipment is designed for operating at two speeds, giving a rope speed of 1,550 ft. per minute when handling material and a rope speed of 800 ft. per minute when handling men. The control equipment is so arranged

that the change from one speed to the other is obtained simply by throwing two lever switches from the "up" to the "down" position, or vice versa.

The equipment consists of a d.c. hoist motor rated 600 hp., 400 r.p.m., 550 volts and connected to the hoist drum through reduction gearing. A motor generator, consisting of a 450-kw., 750-r.p.m., 550-volt generator; a 500-hp., 750-r.p.m., 6,600-volt, 3-phase, 25-cycle, phase-wound induction motor, and a 16,500-lb. steel-plate flywheel furnish power to the hoist motor. Excitation for the generator, the motor, and the control equipment is obtained from the same motor-driven exciter set as is used for the ore hoist. The control consists of a slip regulator for the induction motor, a controller, contactor panel and resistance, together with auxiliary devices for the generator field. The generator field current is handled directly by contactors, and the contactor coil circuits only are handled on the controller. This makes it possible to introduce current-limit control of acceleration and retardation and also voltage control of the acceleration.

As this equipment is used a large part of the time for handling men, it was necessary to introduce a method of preventing too rapid acceleration or retardation and to limit the rope speed to a certain definite value, as required by the laws of Arizona. The rate of acceleration is limited by means of voltage relays and current-limit relays. The voltage relays, six in number, have their coils connected across the generator armature and are calibrated to pick up at different values of voltage. The tips of these relays are connected in the control circuit for the field contactors, and it is therefore impossible for the field contactors to close at a faster rate than that at which the generator voltage builds up. Even if the controller were thrown immediately from the "off" to the full "on" position, the field contactors would close at a definite rate as determined by the closing of the voltage relays.

In addition, there are two current-limit relays whose coil circuits are connected in series with the armatures of the generator and motor, their operation thus being determined by the amount of current flowing in this circuit. They are so connected that if the current exceeds a certain predetermined amount, these relays will function to prevent any more of the field contactors from closing until the current has again dropped below the pick-up value. This arrangement gives positive control of the rate of acceleration and complete protection of the equipment against abusive handling. During retardation, if the controller is moved quickly from the



The 450-kw. flywheel motor-generator set for man and material hoist

"on" to the "off" position, it will cause the motor to pump back as a generator, and, if the value of this pump-back current exceeds the pick-up value of the current-limit relays, one of these relays will function, thus preventing any more of the field contactors from dropping out until the current has dropped below the setting of the current-limit relays.

The two current-limit relays are definitely polarized from a constant potential source; hence one relay will always operate on acceleration and the other one on retardation.

This equipment is arranged to make use of the "suicide" connection, as described for the ore hoist, and the brakes are arranged to be applied automatically in case of emergency. The usual safety features are incorporated, including track-type limit switches installed in the headframe to be operated directly by the cage or the counterweight in case of over-travel, when they would make an emergency stop. A geared-type limit switch is also provided, geared to the hoist drum and so connected that it will cause an application of the brake in case the cage over-travels a short distance at either of its limits. The hoist equipment itself is equipped with a Lilly controller which gives over-speed and over-wind protection and incorporates a throw-over device for changing the over-speed setting when handling material or men.

The change from high to low rope speed is accomplished by introducing a block of resistance in the generator field circuit to prevent the generator voltage from building up above a certain predetermined value. When handling men at the reduced speed and voltage setting, it is, of course, necessary to recalibrate the voltage relays, so that they will pick up at a correspondingly lower value of voltage than when handling material. Also, it is necessary to recalibrate the current limit relays, so that they will function at a correspondingly lower value of current to limit the accelerating time to a certain predetermined value. All of these functions are taken care of when the two lever switches are thrown from the upper to the lower position, after which hoisting can continue exactly as before, except at the lower rope speed.

This hoist is equipped with the same emergency protective features as the ore hoist and an emergency stop will follow from any of the causes previously itemized.

No attempt has been made here to give a complete description of the operation of the controls, and there are many interesting features in both equipments which are necessary to the operation which have not been mentioned. It would needlessly complicate this article to attempt an itemized description of the operation of each of the control devices. Suffice it to say that the equipments have been put into successful operation and have fully met all expectations.

Fuller's Earth Production for 1924 Largest on Record

The largest output of fuller's earth on record is that for 1924, as reported by the U. S. Geological Survey. Thirteen operators in six states reported that 177,994 short tons of fuller's earth were sold in 1924, valued at \$2,632,342, or \$14.79 a ton. This output is 19 per cent greater than that of 1923, but it is more than four times that of 1914. The value of the output for 1924 was also the largest ever recorded. It was 17 per

cent greater than that of 1923 and 5 per cent greater than that of 1920, the previous year having the record of greatest value. It was more than six times as large as that of 1914. Since 1920 there has been a steady decline in the average price per ton, the price in 1924 being nearly \$5 lower than that of 1920, the year of highest average.

The South continues to produce the larger part of the output. Georgia was the leading state in output and value, displacing Florida, which had occupied that position since the beginning of the industry. Florida was second and Texas was third in output and value. These three states reported 93 per cent of the output and value in 1924. The producing states, named in the order of their output, were Georgia, Florida, Texas, Illinois, Massachusetts, and Alabama.

Fortunes in Mexican Bonanzas and How They Were Spent

Brief stories of several individuals who made great fortunes out of bonanza mines in Mexico are related in a recent issue of *El México Minero*. For instance, Doña María de la Campalos, Countess of San Mateo de Valparaiso, worked the mines of Veta Grande, at Zacatecas, for her own account and obtained large profits.

Don José de Zambrano made himself immensely rich in the mines of Guarisamey, State of Durango. The Quinto tax only (the Crown's Fifth), which he paid to the royal treasury, amounted to eleven million pesos. This rich miner constructed the old theatre and a vast home in the capital of the state, the house being now the Government Palace. It is said that he wanted to put silver railings around his balconies and asked permission to do so; but this was denied him as it was considered that he would then exceed the very viceroy in ostentation, as the latter could not afford such luxury.

Father Flores found extensive galleries in his mine, Bolsa de Dios Padre (Pocket of God the Father), Catorce, San Luis Potosí, filled with chloride of silver which in a short time yielded three million pesos.

Don Miguel Sánchez exploited the Candelaria mine at Metatitos, State of Durango, soon becoming a millionaire. This lucky miner spent his money in extravagances and entertainments. He wore showy trousers with rows of gold doubloons as buttons.

Don Pedro Echeguren, a Spaniard, was the owner of the Guadalupe de los Reyes mines in the State of Sinaloa. He was the founder of this great enterprise which was worth fourteen million pesos. He married in the country and took his Mexican daughters on a trip to Europe, where they married three ruined noblemen: the Count of Dampiers, the Viscount of Cholett, and the Baron de Loupée.

Don Joaquín Contreras, a famous and audacious Durango miner and very capable mining prospector, enjoyed the proceeds of the celebrated bonanza in native silver of the Peñoles mine, and was the owner of the famous Promontoria mine, also in Durango. He led a sumptuous existence and was a favorite of fortune. Later on his riches dwindled and he died in extreme poverty.

Don Pedro Alvarado found an enormous pocket of high-grade ore in his mine, La Palmilla, at Parral, Chihuahua. He made himself famous throughout the republic for his offer to the government of Porfirio Díaz to pay the foreign debt of Mexico.

Recent Developments in Open-pit Mining

With Special Reference to the Equipment Developed and Methods of Blasting

By Robert Marsh, Jr.

Consulting Mining Engineer, San Francisco, Calif.

A FEATURE of foremost interest in steam-shovel operations is the general adoption of caterpillar mountings for a wide range of shovels, including both the revolving and the railroad types. This kind of mounting has gradually been so perfected in design that it has not only replaced many of the traction-wheel mountings on the smaller and medium sizes of revolving shovels, but also the railroad trucks on the largest sizes of this type.

Tried-out performance of caterpillar mountings has proved the fully satisfactory mechanical development of the design. It has also shown material economy in operating costs; first, because of elimination of lost time, with consequent increase in shovel output; and, second, in the decrease of pit labor. At a number of properties where the railroad type of shovel has been equipped with caterpillar mounting, the saving in operating time has amounted to from 10 to 20 per cent, with a corresponding increase in output. The number of pitmen per shovel has been decreased in many cases from five or six to two.

INCREASED MOBILITY OF SHOVELS

Time is saved principally in moving up, as there is no bed to smooth, rails to lay, and jacks to release and reset. The shovel is always mobile, enabling it to make short, quick moves to effect the best digging distance. This mobility also makes for safety in moving back from treacherous banks. To move back from a blast or a slide requires only a few seconds. Then, too, the wide supporting base of the treads affords a very solid foundation, largely eliminating strains and vibration. On account of the design of the tread, operation is practicable over rough ground, and even with a foot or so of water in the pit.

These mountings for the railroad type of shovel consist of two forward caterpillar units swiveling on jack arms, and a rear caterpillar truck supporting the rear end of the shovel. The different manufacturers supply two or more sizes to fit the different sizes of shovels. The two forward trucks are propelled together. The rear truck is arranged to swivel in either direction, and adjusts itself to uneven bottom. The three-point support of these trucks prevents twisting of the car body. Some makes offer two types of rear units—the short unit which may not be propelled, and the long unit which may be propelled. The former is suitable for hard bottoms and the latter for soft bottoms. Treads are furnished in either 24 or 36 in. width. The wider tread is generally preferable on the heavier shovels. The propelling speed is about one-half mile per hour, and 15 to 20 per cent grades can be negotiated.

The design allows for ease in taking up wear, self-cleaning driving gears, overlapping continuous pads of cast steel on solid cast side frames, and tread rollers. The Alemite system assists in good lubrication. All steering is controlled from the cab.

When necessary to make long moves, such as from one bank to another, it is usually advisable to change from

caterpillar trucks to railroad trucks to make the change. A special bullnosed coupler casting for the front of the shovel is provided, and a special center casting at the rear. Trucks can then be run under by simply removing the jack arms and the front caterpillar proper. The propelling mechanism remains in place. The special front-end casting shifts the position of the front trucks forward, so that they do not interfere with the



Caterpillar tractor shovel at Utah Copper open pit

caterpillar propelling machinery. The time required to change from caterpillar mountings to railroad trucks is about a half day, once the crew of say six or eight men is familiar with the method of effecting the change.

The cost of caterpillar mountings for the railroad type of shovels of about 100 tons' weight is from \$10,200 to \$12,500, and the shipping weight is from 53,000 to 65,000 lb.

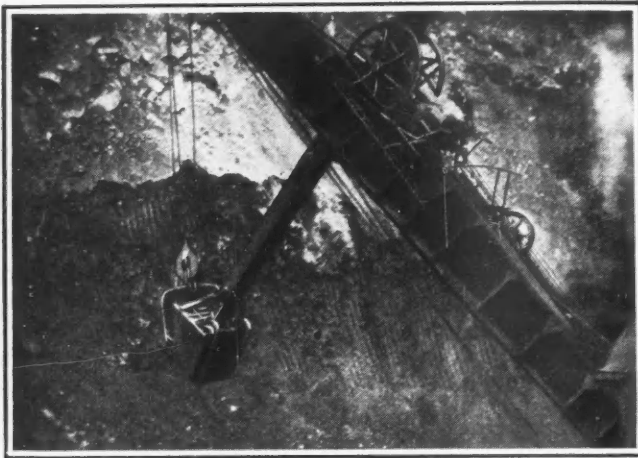
The advantages of caterpillar mountings may be summarized as follows:

1. Quicker moves.
2. Reduction of pit crew.
3. Less danger from banks, blasting, and overturning.
4. Firmer foundation (no loose jacks) and less strains to shovel and crew.
5. Easier to work in water.
6. Better traction on steep grades.

A disadvantage is in the time required (one-half day) to change from caterpillar to standard trucks, when making long moves.

LARGER REVOLVING SHOVELS

Following the demand for a larger, sturdier shovel of the revolving universal type, the leading manufacturers of shovel equipment have perfected one weighing about fifty tons. Examples of this newer machine are the Bucyrus 50-B and the Marion Model 37. These shovels carry dippers of 1½ to 2-cu.yd. capacity. They are adapted to a broad range of work in quarries, gravel pits, general excavation, and mines of moderate output; also in loading coal behind large coal-stripping shovels. For this last-named purpose these shovels are usually



A Marion 300 shovel operating at United Verde

equipped with an extra long boom and dipper stick, and a specially designed dipper. Of somewhat lighter weight is the Osgood 1½-yd. heavy-duty shovel. Standard equipment for these shovels calls for 1½-cu.yd. dipper, 25-ft. boom, and 17-ft. dipper handle. The high lift equipment calls for ¾ to 1½-cu.yd. dipper, 28 to 32-ft. boom, and 19 to 22-ft. dipper handle. Shovels of the type described above, when electrically driven, are often operated by one man. The controls are all conveniently located, and steering is done from the cab.

It is noteworthy that manganese, chrome, and other special alloy steels are in very general use in shovels of all sizes.

These shovels are often used as drag lines and locomotive cranes, or with clamshell and orangepeel buckets. For the former the shovel is equipped with a 1½-yd. bucket or a 45-ft. boom, or even a ¾-yd. bucket on a 60-ft. boom. For the latter, it carries a 50-ft. boom and a 1½-yd. bucket.

The mountings recommended are of the caterpillar type, but other types can of course be supplied.

Electricity, as the motive power for shovels, has proved very successful, both with the alternating- and direct-current types of motors. Steam may be at a great disadvantage where coal costs are high, with spark and fire hazards, smoke nuisance, inadequate boiler-feed water, intermittent operation, and pipe freezing.

The Diesel engine has been successfully applied to shovels of these smaller sizes. The engines are simple and surprisingly economical in fuel consumption. They may again possess marked advantages where water is scarce or poor, and where coal is costly. The Bucyrus 20-B Diesel shovel is equipped with a 45-hp. mechanical injection oil engine of Diesel type, and for this machine the manufacturers claim an oil consumption of from 1½ to 2 gal. per hour under normal operating conditions. This machine has a unique rope thrust. The thrusting motion on the dipper handle is accomplished by means of a small drum keyed to the shipper shaft and operated by the hoist cable. The Bucyrus company offers the 20-B, 30-B, and 50-B shovels equipped with the Atlas-Bucyrus Diesel engine, and claims a fuel cost for these engines as low as one-eighth that of a gasoline machine. These three shovels are also offered with steam, electric, and gasoline power units. The Diesel gas and electric are offered with the rope thrust.

Although the electrically driven shovel has proved eminently successful, it frequently happens that elec-

tric current is not available from an outside source. To meet this situation a design has been provided whereby the electric current is generated on the shovel. This is accomplished by means of an electric generator direct-connected to a gasoline engine. The Marion company has designed a series of shovels of this type, using direct-current series-wound motors. In this design separate motors are provided for hoisting, rotating, and crowding. This does away with the disadvantages of the older friction-clutch type, using a single motor for transmitting power to the different motions. The control apparatus is simple and can be operated by one man. Overload protective devices prevent stalling the motor. This machine may be converted to the all-electric type by merely changing the gasoline engine and generator for a motor-generator set.

Comparative operating cost with different motive power on 50-ton revolving shovels fitted with caterpillar mountings furnishes the following general comparison and shows the economy of the electric-driven shovel when operating under the conditions specified:

Item	Steam Coal Fired	Steam Oil Fired	Gasoline- Electric	Electric
1 operator.....	\$8.00	\$8.00	\$8.00	\$8.00
1 fireman.....	5.00	5.00		
1 pitman.....	4.00	4.00	4.00	4.00
1 electrician.....			3.00	3.00
Fuel, 6 bbl. fuel oil@ \$1.40.....		8.40		
Fuel, 60 gal. gasoline @ 15 cents.....			9.00	
Fuel, 1½ tons coal @ \$6.....	9.00			
Electric power, 450 kw.-hr. @ 1 cent.....				4.50
Water supply.....	1.25	1.25		
Oil, waste, and incidentals.....	1.25	1.25	1.00	0.50
Repairs and renewals (new shovels)....	1.50	1.50	1.25	1.00
Operating cost (per day eight hours)...	\$30.00	\$29.40	\$26.25	\$21.00
Operating cost per yd. at 800 yd.	3.75	3.68	3.28	2.63
Approximate cost of shovel (at mine)...	23,300	23,500	26,500	26,000
Interest and depreciation at 16 per cent per year.....	3,760	3,760	4,240	4,160
Cost per yard at 50,000 yd. per year....	0.75	0.75	0.85	0.83
Total cost per yard.....	4.50	4.43	4.13	3.46

Note: The item of repairs and renewals will increase as the equipment ages.

From the foregoing comparison, and under the conditions therein assumed, the electric-driven shovel shows much lower operating costs than any of the other three. If the gasoline-electric shovel were equipped with a Diesel engine instead of a gasoline engine, and if the fuel cost of the former could be reduced to say one-fourth of that of the latter, then the operating cost of a Diesel-electric would appear to be the lowest of all.

There is such a wide range of sizes in shovels of the revolving type—say from the Bucyrus 20-B with ¾-yd. dipper to the Marion Model 350 with 8-yd. dipper—that the general specifications and working ranges should be carefully considered in connection with any selection of equipment.

The 300-ton class of revolving shovels has emphasized the following:

ADVANTAGES

1. Increased capacity with given number of men. The work of the crew is pleasanter, especially in wet weather. Few moves are necessary.

2. Elimination of 75 per cent of track work when opening up ground by thorough cutting. They can go as low as 56 ft. per cut, instead of, say, 10 to 12 ft. as with the 100-ton railroad type of shovel, and load into cars. This means about one move, versus five or six moves of track, with the attendant saving in track labor.

3. They are of great advantage in the making of reduction cuts.

4. They are able to cast aside, or behind, very large rocks. One of their principal applications is where labor is scarce or hard to keep.

The disadvantages may be stated respectively as follows:

1. These largest shovels require large (8-cu.yd.) dippers to show efficient loading. The swing is slow.
2. They do not show unusual efficiency in hard rock.
3. Require especially good runners.
4. When out of order they reduce the yardage output very greatly; hence they are not so flexible as units as the smaller shovels. They are less easily repaired.
5. They are hardly as highly developed yet as the older standard-type shovels.
6. They require a higher initial capital outlay per ton of plant capacity.
7. It is slow and costly to move them about the job.
8. They should load above grade unless equipped with special dippers discharging from the front.
9. They cannot sort ore and waste so closely as the smaller shovels.
10. They probably show more wear on the cars because of dropping heavier loads.

So many of these large shovels are now electrically driven that it may be interesting to mention the four systems of electric drive. Using direct current—(a) Rotary transformers in permanent substations; (b) motor-generators, or rotary transformers, on the shovel. Using alternating current—(a) Low tension distribution to shovels from transformer houses; (b) high tension (say 2,200 volts) distribution to shovels with a.c. transformers on the shovels. The selection of the most suitable system requires a study of local conditions.

It may be noted in passing that steam-driven shovels may be converted to electric drive. It is questionable, however, if this practice is really economical in the long run, especially if the steam equipment is somewhat old; it would be preferable to endeavor to dispose of the steam-driven shovels, replacing them with standard electric machines.

SPREADER PLOWS

The Bucyrus Class 50 spreader plow has been brought out as an unusually heavy rugged plow, capable of handling large yardages or rough material. It successfully plows and spreads frozen material such as ore, glacial drift, and ice and snow. It may also be used to build up embankments to any elevation in 7-ft. steps without the use of trestles. Its width of spread is from 12 to 22½ ft. and it will cut from 19 in. above to 24 in. below top rails. The central pilot plow plates are set at a sharp angle for plowing snow and ice from the track. The hard flanger knives attached to these plates may be so lowered as to cut clean to a depth of 2½ in. below rails from end to end of ties.

In the construction of the big wings are embodied shoulder and ditching attachments. These ditcher blades are operated pneumatically, so that the ditch can be discontinued at any point, and again picked up without stopping the machine.

These machines weigh about 70 tons, of which 60 per cent is made up of steel castings. They are far heavier and more serviceable than the earlier types of spreaders, and are very useful on large works.

As a labor saver on dumps, in the pits, or other places where much track shifting must be done, mechanical track shifters are of real practical service. One of the newer designs is a small but efficient machine called the Peterson patent track shifter, and built by the Superior Iron Works Co., of Superior, Wis. This machine is driven by a gasoline motor. The track and machine are

raised and shifted by means of a central spud. This spud may be set at different positions between the rails and inclined at any desirable angle to accomplish the desired shift. It is raised and lowered by a rack and pinion. The design is good, but more of the cast-steel working parts should be replaced by forgings to give greater strength.

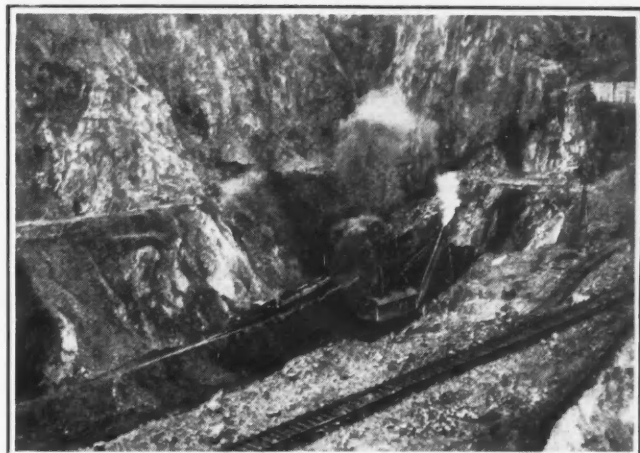
DRILLING AND BLASTING

During recent years more care and study has been given to both class of explosive to be employed and to the systematic planning and standardizing of the blasting operations. The efforts so spent have been well repaid in economy of explosives and efficiency of output.

In open-pit work we still find the same three general methods of chambering—namely, with machine drills, well drills, and tunnels. Each has its own advantages according to the local conditions of the problem.

Many quarries show efficient results employing jackhammer drills, even when drilling holes to depths of 20 ft. or more. Such holes are of comparatively small diameter, and usually require considerable springing to accommodate the required charge, but the lightness of the drills and steel makes them so mobile as to be at a great advantage on some classes of work. Jackhammers are also of great service in block-holing boulders and oversize material, and there is no question that they are an essential part of the equipment in any pit where much secondary blasting must be done. But where great mobility of the machine drill is not essential, and where holes from 20 to 30 ft. or more in depth are required, then a tripod drill of the Leyner Ingersoll Type X-70 or the Models 31 and 34 Turbro drills of the Denver Rock Drill Co. are more useful than the jackhammer. The holes drilled are of larger diameter, the drilling speed is greater, and deeper holes are possible—features which lend preference to this newer type of drill.

Although the method of blasting with machine drills is employed in many quarries, it is hardly to be favored where the conditions are such that either of the other two methods can be satisfactorily employed. To employ machine drills, the benches should be quite low, or else both bench and toe holes must be drilled. The holes usually require springing several times, so that they will carry the charges, and this is tedious, somewhat dangerous, and usually expensive. These holes require closer spacing, which necessitates the drilling of more of them, and hence more drills and crews. How-



Open-pit operations at United Verde, Jerome, Ariz.

ever, on benches 15 ft. high or lower, the well drills are at a disadvantage. This is also true if the formation be unusually hard, and if it be cut by numerous seams at steep dips, so that fitchering and crooked holes give much trouble. On benches 30 ft. high or higher the well drills are to be preferred. Under some quarry conditions machine drills are used to advantage in supplementing the work of churn drills, especially in drilling toe holes.

In choosing between "coyotes" or tunneling versus well-drill holes, one must consider the structure of the



A bench at the Utah Copper mine

deposit to be broken, the height of bank to be worked, the degree of fragmentation expected, the latitude in choice of explosive, and the cost of the equipment to be employed, as well as other local factors.

It generally has been found that where the rock lies in horizontal beds, tunnel blasting is not suitable, owing to the risk of the shot being unsatisfactory and to the fact that a larger quantity of explosive is required to do the work. On the other hand, where the rock is more or less vertically bedded, massive, and not too seamy, good results with tunnels can be expected with reasonable powder consumption. Moving drill rigs over very rugged ground, or drilling in hard, seamy rock where the holes are likely to ravel badly, may seriously militate against the use of well drills.

It is apparent that with a low bank, the cost of tunnel driving and back-filling will be excessive because of the small amount of burden to be displaced. Some quarrymen adopt the rule that for successful tunnel blasting the bank should be higher than the length of the main tunnel. This is to permit of sufficient explosive being loaded in the tees to kick out the bottom of the toe, and then allowing the overlying material to collapse and break in falling. Banks less than 100 ft. high scarcely lend themselves to tunnel blasting, though some as low as 60 ft. are thus shot.

The degree of fragmentation likely to result by different methods of blasting is usually of much importance. Unless large pieces of rock are especially desired, such as for jetties, the smaller the material is broken, the easier it is handled with the shovels. If the toe of the bank can readily be broken into small pieces, while the upper portion breaks in large pieces, then tunnel blasting is at a serious disadvantage over well drilling. Naturally, the structure of the rock has much to do with the degree of fragmentation, regardless of the method of shooting. But, other things being

equal, this difference in breakage is due largely to the difference in the distribution of the explosives with the two methods. In tunnel blasting, it is confined to the bottom, but in column-loaded well-drill holes it is distributed throughout the bank to be broken. Large amounts of oversize material require much secondary shooting or the employment of heavy shovels using large dippers. Secondary shooting is to be avoided, and the shovel equipment should be selected to meet the requirements of tonnage output rather than to handle oversize.

The method of blasting adopted will usually govern the class of explosives to be employed. In tunnel blasting it is generally customary to use low-grade cheap powder, such as black blasting, or R. R. P. These powders have a heaving effect which throws the rock a considerable distance out on the quarry floor; they act too slowly to do much shattering. They are not to be recommended in seamy rock, because of the likelihood of blowing out through the seams before having a chance to move the burden. The R. R. P. of 5 to 10 per cent is much better suited to ground of seamy character, and is in general use in the West. On the other hand, well-drill holes column-loaded with such an explosive as 40 per cent ammonia dynamite will break the rock smaller and not heave it far. It is often profitable to do some experimenting before making a final selection of powder.

TUNNEL METHOD OF BLASTING EFFICIENT IN WESTERN QUARRIES

Many quarries in the West are blasting by the tunnel method. In these the stratification generally dips at steep angles. Here the distribution and weight of the powder charges must be given careful study to insure proper lengths of main tunnel and crosscuts and proper spacing and charging of powder chambers. These workings are usually driven "wheelbarrow" size. The main tunnel penetrates the bank to a distance of say two-thirds of its height. With very high banks where great quantities of powder can be used, several crosscuts can be driven, but the general experience has been that the shorter tunnels, say 60 to 75 ft., with a single tee, give the cheapest and best results. The length of crosscuts is dependent on the amount of material to be broken or the length of face to be shot. From this method of blasting one may expect to break from three to five tons of rock per pound of explosive. With well-drill holes, the problem of weight and distribution of charges is taken care of in the proper spacing arrangement and loading of the holes. Experience has shown that the great majority of well-drill work can best be handled with holes 5½ to 6 in. in diameter.

The cost of equipment with "coyote" blasting is small. If compressed air and jackhammer drills are already available, there is practically nothing to add, or the work may even be done by hand. With machine drills, more compressor capacity, as well as the cost of the drilling equipment, must be added. With well drills, additional capital is again needed to purchase the rigs and tools. These items must be allowed for and carried in computing final costs.

The foregoing gives only a brief outline of the present practices of open-pit blasting. Many details must be considered for each stage of the work if the best solution is to be found for each quarry. But a few remarks regarding the choice of explosives to be used in open-pit work will be pertinent. The objections to

powder gases or danger from coal gas and dust explosions are absent, but cold and moisture must be considered. The oldest powder is common black blasting powder, and at some open-pit mines, where 6-in. well drill holes are used, and where the material to be blasted requires little disruptive effect, it may still be the most economical powder. This powder has only about one-third the disruptive effect of granulated nitroglycerine powder. Formerly black blasting powder was generally marketed in screened sizes. Loading drill holes with a powder having grains of a more or less uniform size naturally left a large percentage of voids, and hence gave a less concentrated charge. Realizing that drill-hole space was valuable, the logical thing to do was to fill these voids, so that now black powder is marketed with the grains of such a graded size that there will be a minimum of voids left in the charge. In other words, more weight of black powder can be loaded per foot in the barrel of the hole. Then, too, the rate of explosion propagation in black powder is comparatively slow, so that an appreciable time interval elapsed for the explosion to travel from the point of commencement throughout the length of the charge in the hole. By substituting Cordeau Bickford detonating fuse for exploders it was found that complete explosion of the charge was greatly accelerated. These two departures in the loading and firing of black powder charges in well-drill holes have greatly added to its utility and economy.

APPLICATIONS THAT FAVOR USE OF STRAIGHT NITROGLYCERINE DYNAMITE

Straight nitroglycerine dynamite is again the oldest type of the high explosives, and for many uses it is still the most economical. Field experience and laboratory tests have shown that 40 per cent straight nitroglycerine dynamite produces greater disruptive and propulsive effects than any other powder of comparable grade. Tests have further shown that this powder is even somewhat stronger than 60 per cent low-freezing dynamite, although it should be noted that this 60 per cent powder contained but 41.43 per cent nitroglycerine and 2.61 per cent moisture. It therefore follows that straight nitroglycerine dynamite is more economical in such blasting operations where the conditions and character of the work are such as to favor its use. Similar studies have shown that 40 per cent ammonia dynamite and 40 per cent gelatin dynamite are more efficient and economical where the work requires a large propulsive effect but a relatively small disruptive effect. Such may be the condition in blasting softer rock.

There are many grades of special powders, manufactured by the different large powder companies, which are especially suitable for certain quarry conditions. They ought to be considered along with the more standard better established types. The use of liquid oxygen explosives is perhaps not yet sufficiently well developed in this country to warrant positive conclusions as to its real economy. It has been extensively used abroad for several years, and its further development will be watched with great interest here. The ability of well-drill holes to use cartridges of large sizes is a point in its favor. Its comparative safety is another, but the rapid deterioration of the cartridge, due to the volatilization of the oxygen, makes it necessary to fire the charge very quickly after loading.

Other points that continue to be impressed upon powder users everywhere are the economy of using cart-

ridges of as large size as possible; the distribution of the explosive; increasing use of Cordeau Bickford, No. 8 blasting caps and electric firing; and careful stemming and tamping.

Large-size cartridges avoid excess paper in the charge, reduce voids, are less sensitive to chill, and generally detonate better.

Distribution of the powder charge is determined both by the spacing of the charges in chambers or drill holes and by distribution of the charge in each drill hole, such as in the column loading of churn-drill holes.

Cordeau Bickford, a detonating fuse filled with T. N. T. and having a detonating rate of about 17,500 ft. per second, speeds up the explosion to the same rate along the entire column of a charged hole. This increased rate of propagating the explosion of the entire charge greatly increases the disruptive effect of black powder and the slower dynamites. Since the Cordeau extends to the full depth of the hole, it affords an ideal detonator for column loaded holes, where the charge may be broken at required intervals. Some of the claims for Cordeau are that it increases the useful work performed by the explosives fully 10 per cent, practically eliminates the occurrence of missed holes, reduces the time of loading and connecting, serves ideally for broken charges, increases the safety, as it cannot be easily set off by friction, shock or fire, and leaves no missed holes or unexploded caps.

Extensive tests have shown that the use of No. 8 detonators not only assures more complete detonation but greatly reduces the percentage of failures of explosives to detonate. This is especially true of the gelatin powders. Missed holes are both expensive and dangerous, and No. 8 detonators unquestionably reduce their number. Electric blasting caps permit the firing of a large number of holes simultaneously, or by using delay electric blasting caps, the firing may be done in rotation or groups. These features may prove advantageous in some quarries. They may also prove safer than firing by caps and fuse, because the firing is done without haste and misfires are rarer.

STEMMING AND TAMPING INCREASE EFFICIENCY

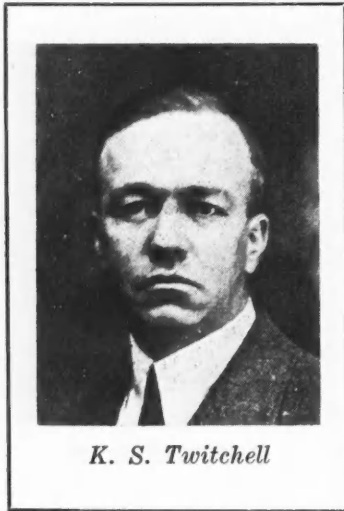
Similar experience has conclusively proved that stemming and tamping increases the efficiency of all explosives, but especially that of black powder and the weaker dynamites. It is recommended that churn-drill holes carry well-tamped stemming for a length of at least three times that occupied by the explosive; the larger the diameter of the hole the greater the length of stemming that should be used. Different stemming materials vary in the effect they have on the efficiency of different explosives, but the general conclusion is that moist fireclay, or some such plastic material, is the best stemming for all explosives, especially so for black powder, and that dry pulverulent material, such as dry fine clay, is least efficient. It is claimed that by the use of the most efficient material, the useful energy of some shots may be increased 90 per cent, and by the least efficient material, by 60 per cent. These tests clearly show that stemming is necessary for any shot when maximum useful explosive effect is desired. For further details of tests see Bulletin 48, Bureau of Mines; Technical Paper 17, Bureau of Mines; "Steam Shovel Mining." Marsh: McGraw-Hill Book Co.; "Scientific Quarry Blasting," *Explosives Engineer*, April, June, July, 1923, and "Eliminating Waste in Blasting," by Greensfelder.

Some Mineral Resources of Portugal

Conditions Under Which Mining Is Carried On—Its Limitations and Prospects

By K. S. Twitchell

Mining Engineer, Lisbon, Portugal



K. S. Twitchell

IN PORTUGAL there are thousands of "mines" registered in the "Repartição dos Minas," or Mining Department, and many mining concessions have been granted, but little active and intelligent prospecting or development is being done, and comparatively a small amount of actual mining. The mining laws are sound and fair. The government holds title to all minerals. Any one, citizen or foreigner,

has the right to prospect in Portugal. When a mineral discovery is made on which a location is desired, a "registo" is declared, which is a statement made on legal paper and filed at the nearest county seat. This "registo" is good for sixty days and gives the right to do prospecting work in an area of 560 m. radius of the point of discovery or location filed. Permission from the owner of the surface is required as a preliminary to prospecting. If he refuses this the miner applies to the county "administrador," who appoints a commission to calculate the damages which will be done, the miner pays them and proceeds with his work. If he desires additional time for prospecting, then a "licença para pesquisas" is obtained from the Department of Mines, which gives two years more for prospecting and development. No ore can be shipped during this period except under special permit as a sample lot.

If the findings are favorable a "concessão"—concession—is applied for before the expiration of the two years. This concession is usually in the shape of a rectangle of 500 m. x 1,000 m., which is included within the circle. It has an area of 50 hectares, or 123½ acres. From eight months to a year is usually required to obtain the final and formal documents from the government. These convey perpetual rights to mining in this area for the mineral specified or the rights continue till the property is abandoned. A formal notice of abandonment must be given to the government. A concession can be cancelled if all rules and requirements are not obeyed, and among these is that work must be continuously prosecuted. I have never heard of a cancellation, though I have seen many concessions without a particle of work being done on them. On granting a concession a book of "guias"—permits—is given by the government, and one of these permits must accompany every ore shipment. Railroads will accept no ore without a "guia."

The maximum royalty to be paid to the federal government is 3 per cent of the "value of the ore at the pit's mouth." The legal maximum sum of all town and county taxes is less than 2 per cent on the same basis,

so the total of all taxes and royalties is less than 5 per cent of the value of the ore at the collar of the mine.

The low cost of labor, which is of very fair quality, is a great advantage in Portugal. The price for underground work of eight hours per shift varies from 40c. to 80c. (10 escudos to 20 escudos), the higher figure being only paid under exceptional circumstances or gained by most favorable contracts. The best mechanics get up to 30 escudos, or \$1.20, per day. These prices in American money are based on the exchange rate of 25 escudos to \$1. About Aug. 1, 1924, the rate was 35 escudos to \$1. It is more likely that the escudo will again decrease in value rather than improve.

The cost of supplies is not excessive, the duties on mining machinery being light. The railway charges are not abnormal, but the service is poor. With the provision of new equipment from the German reparations the service should be considerably improved. Some of this rolling stock is now being put into use. The base of supplies being either London or New York, there is a direct sea freight to Lisbon. As Portugal is roughly only 300 miles long by 100 miles wide, the railway distances are comparatively short.

The total average costs of development work on one of the properties I have been directing from June, 1923, to June, 1924, have been as follows; with the exchange rates of 120\$00 = £1-0-0 = \$4.50:

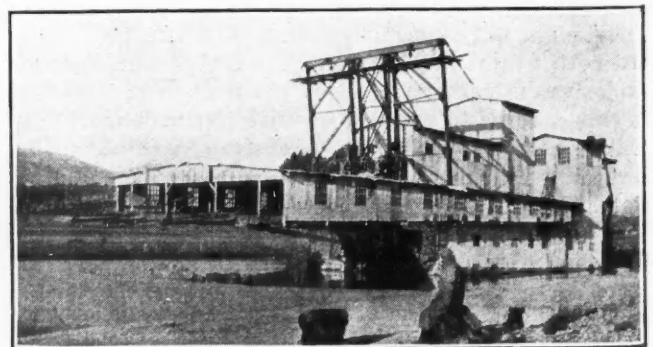
			Per Foot
Drifting, per linear meter.....	195\$67 =	£1-12- 7 =	\$7.32-\$2.23
Crosscutting, per linear meter....	232\$28 =	1-18- 9 =	8.70- 2.65
Raising, per linear meter.....	178\$98 =	1- 9-10 =	6.70- 2.04

At another mine at which I have kept cost records the average for the last nine months has been as below. All supplies, labor, and superintendence (which consists of a Portuguese foreman and shift bosses) are included. This mine is a tunnel working with a haul to the dump averaging one-third mile. There is no pumping or hoisting.

	Per Meter	Per Foot
Drifts and crosscuts, 1.5m.x2.0m.,	£1-13- 9 = \$7.58	\$2.31
Drifts and crosscuts, 2.0m.x2.5m.,	2-14-10 = 12.32	3.76

We have done no sinking of importance yet, but in estimates for future work I have put the cost of £6, or \$27, per meter, or \$8.23 per foot for a three-compartment shaft.

The climate in most parts of Portugal is like that of southern California, the temperature varying from the



Tin dredge of the Portuguese American Tin Co. at Gaia, near Belmonte, Beira Baixa, Portugal



Drilling for tin with an Empire rig near Celorico, in Beira Alta

extremes of 30 deg. F. to 110 deg. F. in the shade. The rainfall is about 25 in.

From the foregoing it will be seen that costs and other conditions are extremely favorable for operations in Portugal.

The last official report of the mineral resources of Portugal was published in 1888. There was much more mining activity then than now.

The largest producing mine is the Sao Domingos, in the district of Beja, province of the Alemtejo. This has been a dividend payer for many years. It is owned by Mason & Barry, a British company. The ore is cupriferos iron pyrites very similar to that mined at the Rio Tinto. The cost f.o.b. steamers is said to be 10s. or \$2.25 per ton. As is the case with practically all profitable copper mines in the Iberian Peninsula, there are many evidences of extensive Roman operations in this vicinity. Mina do Aljustrel and Mina



Largest of the Roman stopes at the Vieros mine

Louzal are two other producing mines in the same district, and the ore is of the same character.

There are several mines in the Alemtejo which have been profitably worked for copper alone. Most of these are now closed down, having been worked out, or for various other reasons. Many copper properties are registered, and it is not unlikely that some might develop into productive mines.

Practically no first-class coal has yet been found in Portugal, but extensive lignite deposits exist which are barely touched and which have great possibilities.

Tin is being profitably produced from one lode mine in the northeastern part of Portugal. It is owned and operated by an English company.

The Portuguese American Tin Co. has had a very

profitable record of production of placer tin by dredging. This property is in the district of Guarda, province of Beira Baixa. A new British company, the Mondego Tin Dredging Co., Ltd., has just been formed to work the placer near the above-named American company's ground. Those in control intend to use a suction cutter dredge. T. A. Down wrote an account of this area in the *Mining Magazine* in 1916. Farther south in Beira Baixa a Portuguese company is working a tin placer profitably on a small scale. This is near Medilim. There are doubtless many other areas that would justify careful prospecting. The price of tin, its easy concentration and refining, and the lack of it in the United States make tin mining in Portugal attractive.

Tungsten was actively mined in the northern part

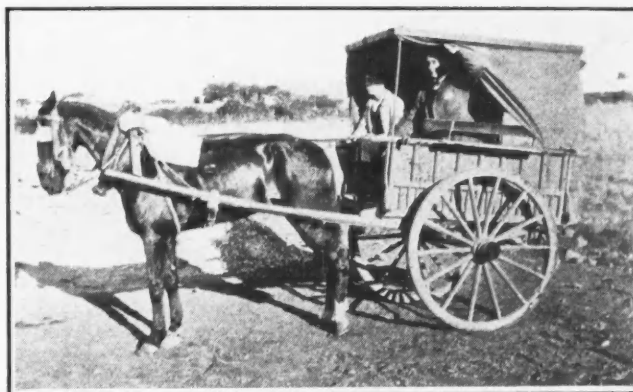


Bunk houses and portal of the Vieros mine

of Portugal in many places during the war. On account of the present very low price and lack of market no tungsten properties are now in operation.

A radium concentrate is being profitably produced at a small mine in the province of Beira Alta, the radium-bearing minerals being autunite, tobernite, and recently what is thought to be pitchblende. The samples I have seen do not show it. The concentrate being produced is a radium barium sulphate. The present depth is only 25 m. below the surface. The ore seems to be improving as it is being followed down, approaching the realization of the prospector's dream and hope of "the deeper the richer." Too little work has been done to make possible an accurate prediction of the future, but it is a very attractive property. It is owned by Norwegian and English interests, and the management is English.

A radium mine near Guarda, owned by the Roth-



Mode of conveyance used for moving express to the mine

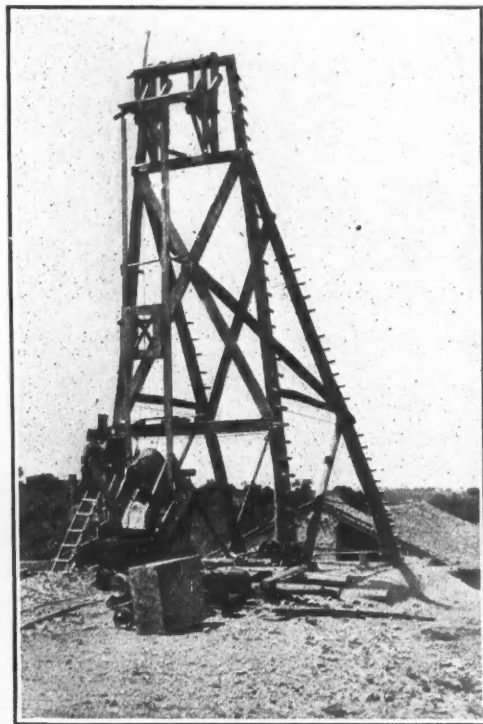
schilds, was worked for several years. The management is French. This mine and a Portuguese-owned mine near by at Sabugal are now idle. High transport and treatment costs are said to be the cause of the shutdown. There is an attractive radium prospect in Beira Baixa south of Guarda which justifies development, but the Portuguese owners are unable to work it, on account of the depreciation of their currency. Probably many other prospects might prove to be mines, but capital for development is lacking.

A few gold, silver, lead, and zinc properties justify work being done. One of the gold properties is said to show evidences of Roman operations. The villagers get a little gold by panning along the tributaries to the river after heavy rains. Many have very old gold earrings and gold trinkets.

Besides the metalliferous deposits of Portugal the non-metalliferous offer possibilities. Some samples of asbestos have been brought to me. If a deposit of sufficient tonnage could be proved, there would be a good domestic field for asbestos roofing shingles. Timber is expensive, and the clay tiles now universally in use are very heavy. The asbestos ones, being lighter, would require much less timber in the roof structure, thereby making such a saving that these tiles should find a ready market.

There are no modern lime kilns in Portugal. The antique intermittent type is almost universally used. The operation of this is much slower, takes more fuel and more labor in charging, and makes a product of an inferior quality. The product of these old kilns varies greatly in quality, and much of it is allowed to air-slake. The modern kiln makes a far superior product more cheaply.

Good gypsum deposits are found and good portland cement is now being manufactured, so there should be no difficulty in making wall boards of the "beaver-board" type. There should be a good local market for such a product, for the same reasons as have been given for the asbestos shingles.



Headframe of eucalyptus at Mina Salvacão do Indio



Portuguese women panning for cassiterite, Beira Baixa, near Sabugal

The Portuguese pottery industry is very profitable, but no systematic exploration of the clay beds is being done by drilling and mapping. Most of the kilns are of the old-fashioned, one-way, beehive, intermittent type. With modern methods of prospecting the clay deposits and modern continuous kilns, using, perhaps, gas generated by lignite gas producers, the costs of production should be materially lowered. A good export market exists for glazed tiles and porcelain electric insulators. The domestic demand for all kinds of material of this type has been exceeding the supply, the larger producers being from six months to a year behind their orders.

There is a small export of marble. The quality of that near Estremoz, in the province of the Alemtejo, is said to be equal to some of the best Italian marbles. The quarrying methods are most primitive. Small isolated pits are dug in various spots. No benches are attempted. The highest face I have seen did not exceed eight feet and was about forty feet long. Channelling bars and machine drills are unknown. A systematically worked quarry should be profitable. A good quality of granite near Evora, the capital of the Alemtejo, is being worked in an even more inefficient way.

Portugal offers many opportunities for profitable investments. Of course, the disregard of the value of time is aggravating to Americans. The mild climate creates a desire for ease instead of hustle, and this is probably the reason that there are so many opportunities awaiting investigation.

Russian Output of Manganese Ore

The output of manganese ore from the Chiatyry mines, in the Caucasus, during the 1923-24 operating year (Oct. 1 to Sept. 30) amounted to 19,544,000 poods (315,225 long tons, 62 poods equaling 1 ton), which represents an increase of 150 per cent over 1922-23.

Useful Operating Ideas

Mining Soft Ores by Improved Top Slicing Method

By S. J. Goodney

The usual methods used in the mining of soft ore-bodies are top slicing and sublevel caving. In both a considerable proportion of the broken ore has to be shoveled into cars, which involves a slow and expensive procedure. Inclined top slicing was invented to avoid the expense of shoveling, but it has the disadvantage of requiring the miners to work on a steep incline. Tuggers and scrapers have certain advantages in reducing the amount of manual labor in top slicing, but additional capital is required for the mechanical installation, and the presence of timbers interferes with the convenient operation of the scraper. Operation and maintenance costs are also high. However, the scraper is an important improvement. The branch raise system gives good results in ground that does not require cribbing to support the raises, but in softer ground that must be cribbed the first cost of the raises is high and it is difficult to keep them open at the points where the branch raises start from the main raise.

When I was shift boss in a mine at Crystal Falls, Mich., in which the sublevel stopping method was in operation, I noted that in the driving of the sublevels in developing a new stope when the miners cut a "dirt raise" (driven from one level to the next at horizontal intervals of approximately 65 ft.) they would drill, blast, and muck two and sometimes three rounds a shift.

However, when they had advanced beyond the raise, the two miners would handle only a single round, more than half of the time being required to muck out the round.

It occurred to me at the time that it might be feasible to arrange a series of small raises from the sublevel immediately below the working sublevel where top

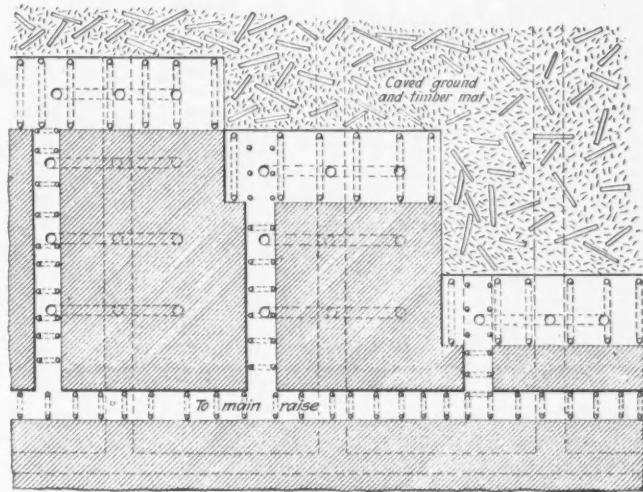


Fig. 3—Plan of top slice level

slicing or sublevel caving was in operation. The small raises are nothing more than holes of relatively small diameter driven vertically, or at a steep angle, from the top or sides of the lower sublevel. The distance would be short and the holes would be so placed as to come up under the pile of broken ore. Inexpensive chute gates, knocked together with boards and lagging poles, could be used to control the ore flow. The driving of the holes could be done by drilling a center hole and using light charges of powder to chamber the bottom of the hole as it was extended upwards.

In the accompanying sketches, I have shown the principal features of the idea. Fig. 1 shows a top slice room served by a small-diameter hole. In Fig. 2, inclined holes are shown intersecting the room in such a way as to reduce the mucking distance to a minimum. The development for this method would necessitate the driving of the sublevel drifts of one slice in a position midway between two contiguous and parallel sublevel drifts on the working slice immediately above. Miners could work in each top slice room without interference from tramping as the tramping for the slicing would be on the sublevel immediately below the rooms in operation on the sublevel in question. The idea was patented on July 22, 1924, as U. S. patent 1,502,030.

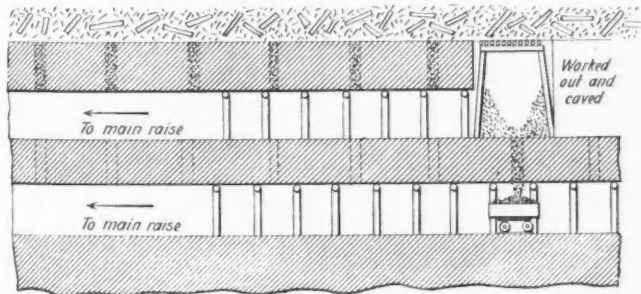


Fig. 1

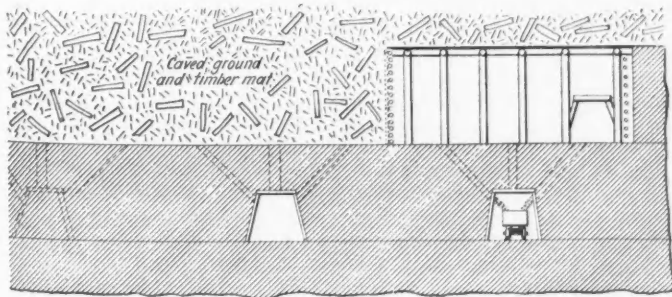


Fig. 2

Fig. 1—Transverse section of top slice room served by an ore pass or raise of small diameter driven from the sublevel immediately beneath. Fig. 2—Longitudinal section of top slice room. Inclined holes are shown intersecting room so as to give shortest mucking distance

Train Haulage Computations

By Samuel G. Lasky

Recently I had occasion to carry out certain calculations for an underground electric haulage system. As many who have done this will agree, it is a tedious process, with many opportunities for errors to creep in.

To do away with the danger of error and to hasten the calculations, the following formula was worked out:

$$(1) \quad T = \frac{60 HLMNC}{60 D + MNCt}$$

- H* = hours per shift;
- L* = number of locomotives in use;
- M* = average speed of locomotive in miles per hour;
- N* = number of cars in a train;
- C* = capacity of each car in tons;
- D* = round trip distance in miles;
- t* = time in minutes per ton for loading, coupling, switching, and miscellaneous delays;
- T* = Tonnage per shift to be hauled.

If it is more convenient to determine separately the time for loading, switching, and coupling cars, the formula will be as follows:

$$(2) \quad T = \frac{MNC(60 HL - t_c - t_s)}{60 D + MNCt}$$

Where

- t₁* = time to load one ton;
- t_s* = total time per shift for switching;
- t_c* = total time per shift for coupling.

As the formula stands it gives the haulage capacity of a given equipment under given conditions of distance and loading.

Conversely, the maximum time that can be allowed for loading may be also determined. The formula will then read as follows:

$$(3) \quad t_1 = \frac{MNC(60 HL - t_c - t_s) - 60 DT}{MNCt}$$

In computing a haulage system for a given tonnage the formula can be transposed to the following:

$$(4) \quad L = \frac{60 DT + MNC(Tt_1 + t_c + t_s)}{60 HMNC}$$

In equation (4) the capacity of the locomotives has been computed to haul *NC* tons at *M* miles per hour over the maximum existent grade.

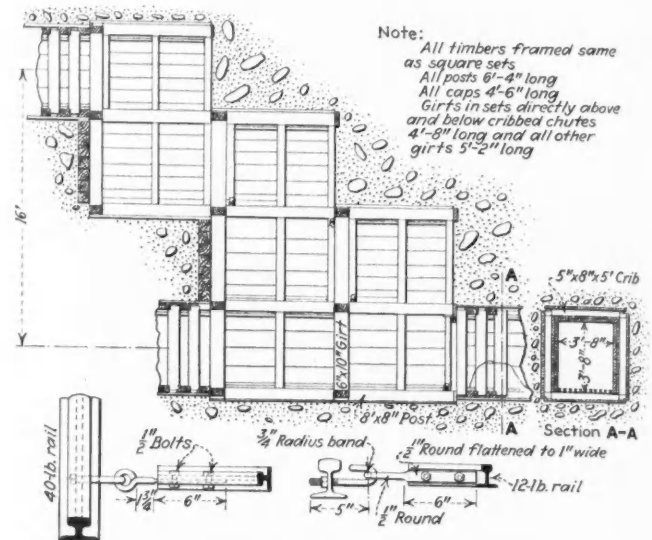
A study of the formula will show that *t*, the time in minutes per ton required for loading and delays, is an important factor and that *D* or *M* can be varied through relatively wide limits without materially affecting the tonnage that can be hauled. The value of *60 D* in equation (1) is relatively small compared with the value of *MNCt*. The average speed has little influence, as it occurs in both the numerator and denominator and in a measure tends to cancel itself. An increase of one minute per ton in the time of loading decreases the tonnage materially, whereas an increase of five miles per hour in the speed, above ten miles an hour, has a comparatively slight effect.

Construction of Offset Ore Passes

A type of offset ore-pass construction designed and in use at the United Verde mine, Jerome, Ariz., is shown in the accompanying illustration. The offset consists of seven square sets which connect with a lower ore pass and two upper ore passes at 16-ft. centers. All of the timbers are framed according to the standard square set in use. Posts are 6 ft. 4 in. long; caps 4 ft. 6 in. long, and girts directly above and below cribbed ore passes are 4 ft. 8 in. long and all other girts 5 ft. 2 in. long.

The ore passes are cribbed, 5x8-in. timbers 5 ft. long being used. The outside of the ore pass is covered with 2-in. boards and the inside is lined with a double

thickness of 2 or 3-in. boards. Rails are placed across the offset at four points to overcome the wear resulting from impact. In addition an apron of 12-lb. rails is placed in the main ore pass to divert the flow of ore



Offset chute construction with wearing rails

downward at the point where the offset begins. These rails are hung from hooks which are bolted to a 40-lb. crossrail placed at the level of the bottom of the first offset set.

Cushioning an Ore Feeder Arm

By Charles Labbe

In certain types of ore feeders, the motion to the arm or tappet operating the feeder is given by the striking of a blow upon it by the stamp or other actuating mechanism. The stiff connection provided and shown in Fig. 1 is not well designed to receive the blow and can be readily improved as shown in Fig. 2.

In this design the feeder arm is reamed out to receive a loosely fitting sleeve which encircles the bumper rod. A spring is interposed between the upper adjusting nut and the top of the arm. This should be stiff enough to transmit the blow but elastic enough to absorb the shock. The adjustability of the bumper rod is not interfered with.

The arrangement shown will reduce the wear upon all of the parts and prolong the service of the parts subjected to direct impact.

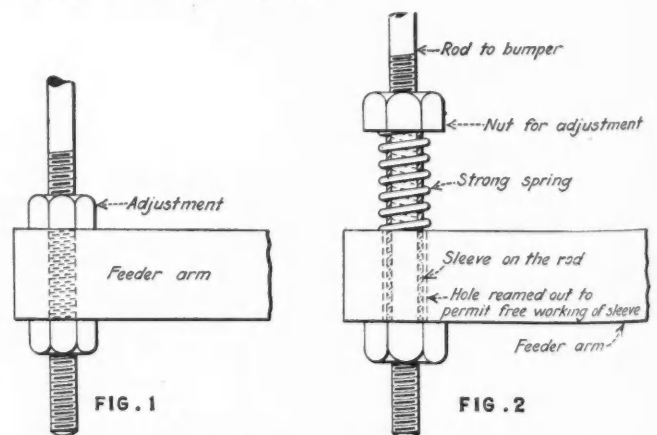


Fig. 1—Ore feeder arm of rigid type. Fig. 2—Improved ore feeder arm designed to avoid shock

Discussion

Hydrocarbon Veindikes and Oil Shales

THE EDITOR:

Sir—There is a paper by the late Captain Lucas in the *Transactions* of the A.I.M.E., in which was published a map of the Gulf of Mexico showing the location at which petroleum had been reported as floating on the surface of the waters. These reports were made by captains of ships which had encountered the petroleum, and the latitude and longitude at which the petroleum was observed were given. Captain Lucas collected these reports over a period of several years and published the map above referred to. Also, there is a map of the Gulf of Mexico in Chamberlin's "Geology," which shows the character of material dredged up from the sea bottom by the "Challenger" and other expeditions when making soundings for navigation charts. From this last source of information it may be observed that the sediments discharged by the Mississippi River are driven to the west and are building a series of shales on the sea bottom in the region south of the Louisiana and Texas coast, while in the region to the east of the delta the sea bottom is covered by coral and shell-bearing animal life that does not thrive in muddy water. From these two sources of information, combined with such other information as has been published about oil shales, with diagrams showing the varying quantity of petroleum in different and closely connected shale beds, I have arrived at the conclusion that the petroleum erupted from the sea bottom gets mixed up with the river muds and makes oil shales. The variable petroleum contents of the shale beds is due to the fact that the petroleum eruptions are irregular, while the discharge of the river muds is constant, so that of two closely related shale beds one may be barren of petroleum and the other rich, while otherwise they are the same. I have read in the newspapers of a large amount of oil which drifted ashore somewhere on the Texas coast, two or three years ago, and covered the beaches for miles. This may possibly have been oil discharged by an oil tanker, but the cases cited by Captain Lucas occurred before oil tankers were in use.

In the *Mining Journal-Press* of Feb. 21 there is an interesting article by Sidney D. Kirkpatrick on the "Marketing of Natural Hydrocarbons," in connection with which are shown three photographs of veindikes of this material in vertical fissures cutting the whole geological section to unknown depth and extending across country for miles. In a neighboring region, perhaps not over a hundred miles to the east, in eastern Utah and western Colorado, occur the enormous beds of oil shales about which much has been published in the *Mining Journal-Press*. It has occurred to me that perhaps there is a close relationship between the two deposits, of widely different character.

The veindikes of hydrocarbons known under several names as gilsonite, uintahite, etc., are but the metamorphosed residues of petroleum and are the probable

sources of eruption of the petroleum in the oil shales. At the time at which the oil eruptions took place both regions were below sea level. The series in which the veindikes of hydrocarbons occur must, of course, be much older and a lower geological horizon than the oil shales. The region in which the oil shales were being formed was receiving a vast amount of sediment from the delta of a river discharging into the sea, which covered both regions.

The petroleum from the submarine fissures now filled with gilsonite, etc., got mixed up with the river mud in the same manner as suggested above in the case of the Mississippi mud and petroleum in the Gulf of Mexico, with the result that the oil shales were formed and hold the petroleum from the submarine source, all of which is of inorganic origin. I have no information on the relative geological ages of the two regions, but from the regional relation and the fact that one contains veindikes of metamorphosed petroleum residues and the other petroleum in shale I think it probable that the veindike region is the older and the source of the petroleum in the others.

About 10 miles north of Victoria mine, Ontario, is a series of veins of carbonaceous material that cuts across the bedding planes of the inclosing Cambrian shales. Locally they have been known as coal or anthraxolite, and a considerable amount of diamond drilling has been done in an attempt to open up a supply for fuel in connection with smelting the nickel ores. They are not in any way related to coal, because coal is conformable to the inclosing sedimentary series, and these veins of anthraxolite cut across the inclosing beds in the same manner as the gilsonite veins of Utah.

From a consideration of the two cases I have formed the opinion that originally these anthraxolite veindikes of northern Ontario were hydrocarbons just the same as those in Utah, and by metamorphic action have lost practically all resemblance to them except that they cut the inclosing beds in the same manner.

Further than this, their close relation to the nickel ranges (they lie between the north and south nickel ranges) suggests that they are the last remnant of the petroleum which accompanied the magmatic segregation that resulted in the formation of the orebodies.

Geneva, Switzerland.

HIRAM W. HIXON.

Electrical Prospecting

THE EDITOR:

Sir—Referring to news item on page 496 of your issue of March 21, 1925, wherein, speaking of the work of the Swedish American Prospecting Corporation in prospecting the Corrigan property of the Federal M. & S. Co. near Kellogg, Idaho, the statement is made in the concluding sentence that the result of their work was of no value, we consider this a misstatement of fact. In the first place, the block of ground given us to prospect was already pretty well prospected by underground workings opened some years ago, of which the

records were thought perhaps unreliable. Our work, to a certain extent, confirmed these records, particularly with regard to the ore discovered by the diamond-drill hole which, according to the article, is to be developed. In the second place, our work was undertaken in the endeavor to locate ore occurrences not known in the workings. The fact that we discovered none indicates, we believe, that none exist.

With reference to the discovery of the already known diabase dike, analysis of our results and of the local structure discloses the probability that Corrigan south vein, faulted by both a northwest-southeast fault and the diabase dike (which evidently occupies a fault plane), is what gave the indication reported, rather than the diabase dike. To be sure, the trenching performed disclosed only the diabase dike, but it is our understanding that the ground is to be crosscut at some depth, and until this is done, it cannot be said that all we discovered was a diabase dike.

Electrical prospecting cannot discover ore where there is none. It may give indications where there is no ore, because of some slightly mineralized basic rock, although a recent advance in the practice of the art enables most of such indications to be eliminated. But where no indications are obtained, the necessity of further prospecting by drilling or otherwise is eliminated, and this much expense is saved. To say that our work on the Corrigan was of no value is not correct, because, as a result, much ground on which a lot of expense might have been incurred in prospecting by diamond drilling or other methods is eliminated as a possibility.

ALLEN H. ROGERS, President,

Swedish American Prospecting Corporation.

New York, N. Y.

Marketing Silica

THE EDITOR:

Sir—I have read with considerable interest the article on the "Marketing of Lump and Ground Silica," by F. E. Wormser, in your March 7, 1925, issue. This subject is a very difficult one to handle, in that silica occurs and is used in so many different forms, and by so many different industries, that producers and consumers of one type of silica are not conversant with the production and use of other types. For this reason it may be of interest to suggest a few additions to Wormser's article.

It is stated that pulverized silica has a moderate industrial application, but I feel that a stronger statement should be made. The consumption of pulverized silica in 1923 was nearly 364,000 short tons, valued at approximately \$2,950,000. Thus, this branch of the industry is really of considerable importance. By far the most important source of pulverized silica is finely ground sand and sandstone. This amounted in 1923 to nearly 250,000 tons, valued at approximately \$1,673,000. This source of pulverized silica was not mentioned in Wormser's article. When the sand source of pulverized silica is taken into account, the most important producing centers are Pennsylvania, New Jersey, West Virginia, and the Ottawa district of Illinois. This ground sand and sandstone type of silica is generally coarse and of low grade. It usually sells for from \$5 to \$9 per ton, f.o.b. mine. Most of the so-called potter's flint is now produced by grinding high-grade glass sand to a fineness of about 99½ per cent through 140 mesh.

The so-called soft or amorphous types of silica are produced only in southern Illinois and in Tennessee. In the southern Illinois district there are a number of producers in Union and Alexander counties in the vicinity of Tamms, Jonesboro, and Elco. The only producer in Tennessee is situated at Black Fox, near Cleveland, Tenn.

There is considerable confusion in the trade and even in the literature in the nomenclature of silica. So-called amorphous silica (which is really cryptocristalline) from southern Illinois and Tennessee is really a type of tripoli, but it differs considerably in appearance and physical properties from the better-known type of tripoli produced near Seneca, Mo. Tripoli is properly defined as a siliceous material derived from the alteration of either a siliceous limestone or a chert. The Missouri type is derived from limestone and the Illinois and Tennessee type from chert.

In the trade only the Missouri type is recognized as tripoli; the southern Illinois and Tennessee type is known as Silica, Silix, Soft Silica, or Amorphous Silica. Though southern Illinois has been practically the only source of the latter type of silica, the deposit in Tennessee is now an important and growing producer.

The market grades of pulverized silica, particularly the finer grades, are not well standardized, and there is considerable confusion among both producers and consumers as to just what grades are actually produced and what grades are needed for specific uses. Since the bulk of the finely pulverized material runs finer than 325 mesh, it is impossible to specify by screen testing the true fineness of this material. This I have previously pointed out in a recent article in *Chemical and Metallurgical Engineering*.¹ In this article it was noted that the finest testing sieve made is 325 mesh. This sieve has an opening of 0.044 mm. In consideration of this fact it is obvious that grades called "450 mesh" and "600 mesh" have no significance and are misleading. The grade should be noted by specifying the screen through which all of the material will pass and the per cent which will pass through 325 mesh. Further than this fineness should be demonstrated by photomicrographs or some similar method. At last one producer has adopted this practice.

The principal uses for the finest ground grades of pulverized silica are in paints, polishes, metal-buffing compounds, wood fillers, phonograph records, and hard rubber. The coarser grades of ground sand silica are used chiefly in ceramic products, in abrasives, soaps and cleansers, and as foundry mold wash.

RAYMOND B. LADOO,

General Manager, Southern Minerals Corporation.
New York, N. Y.

Pull Together

THE EDITOR:

Sir—What is the matter with mining? When one attempts to answer this question, it brings to mind many faults that are "major" and far from being classified as "minor." In fact, the matter with mining is the fact that there is a lack of friendly help and co-operation among mine operators and prospectors to give a helping hand to others engaged in mining

¹Ladoo, Raymond B.: "How Much Does Screen Testing Mean?" *Chem. & Met. Eng.*, Vol. 31, No. 16, Oct. 20, 1924, pp. 623 to 626.

or prospecting for new strikes and future mines in the making. There seems to be a chronic, vicious habit of prospectors and mine operators to "knock" every adjacent mining property or mining district.

Some prospectors will insist that a porphyry-lime contact is the only sure-fire formation that will produce high grade; another will snort at porphyry and swear by pink spar; others will scoff at spar and sink their last cartwheel on a blue limestone contact, while another will stake his all and all on a rhyolite or a diorite dike. Again, others will sneer at any set rule or formation and insist that ore is where you find it—even if it should be in a hollow log. Then there is the pest who is a "belt fiend," and croaks nothing but the "belt," and will have nothing to do with others, or other mines and workings, that, to his narrow view, are "off the belt."

Too many have forty years of mining experience and not forty days of actual practical mining experience. Many are set in their ways and will not take on new methods of mining or milling and will never depart from methods of fifty years ago. They have an intense hatred for modern mining methods and will sulk and refuse to try out new ways and means, and then cuss the luck that sends them to the poorhouse, while their last claim proves to be the potter's field.

Young mining engineers, fresh from school, without practical, common-sense field practice, make the fatal mistake of knowing it all—and if an old, seasoned miner or prospector dares offer a suggestion, he is treated with contempt that causes a constant clash with the old prospectors and the "corduroy experts" that retard mining progress. It often happens that an old prospector can give useful knowledge not found in class books or the lecture room of a mining school—and also, the mining engineer can give practical help and professional aid to the prospector that can never be learned in the field in a hundred years. The mining engineer should value the experience and knowledge of the old prospector, and the old prospector would make a better go of it if he would change his attitude toward the mine expert, and mining engineer, and try to get his noodle filled with modern methods and get out the old ideas that have caused his brain to crack and his prospects to turn out to be nothing but holes in the ground and pay dirt at the end of the rainbow that leaves a lifetime of work a failure.

If the mine operators and prospectors would realize that there is plenty of room for all in the mining field; that by helping others they help themselves and mining in general; if all those interested in mining would pull together, boost together, with one object in view—to help mining, regardless of who is operating—then mining would come back and there would be nothing, not a blame thing—the matter with mining at the present time!

GEORGE GIBBONS HAYS.

Ashcroft, Colo.

Mining Schools in State Universities

THE EDITOR:

Sir—An editorial in the issue for March 14 has started a train of thought which I had sidetracked for a few weeks. The general subject is the education of the mining engineer and especially the schools in which he gets it.

I am not ready for a treatise on the subject, but I do want to emphasize one fact brought out fairly clearly in the editorial: that the work in mining engineering of the state schools other than mining schools is not well known.

The editorial discusses some of the conditions at the state schools of mines and at some of the Eastern universities, and implies that the student must choose between these two classes—Harvard, Yale, or Columbia on the one hand and the state mining schools on the other. It mentions the desirability of the broad contacts of the university, but implies that they are to be found only in a few schools of the East. That implication is an error. That these contacts which make for general culture are to be had in the great Eastern (and Western) endowed universities is true, but they are to be had also in the state universities. The endowed schools have lost their peculiar eminence, not because they have failed to maintain their standing, but because the great state schools have grown into the same class. So, to the universities named in the editorial I add the state universities and agricultural and mechanical colleges, most of which offer to students the broad culture which is desirable for everyone and at the same time as good engineering training as can be had at a school of mines. If I did not have faith in this kind of education I could not continue in it; but I do believe that the student at such a school, though he loses the singleness of outlook from the school of mines, gains more in the broader contacts and appreciations of the university, and that the mining departments of these schools offer all that there is to present-day training in mining engineering except exclusiveness.

C. M. YOUNG,

Professor of Mining Engineering,
Lawrence, Kan. University of Kansas.

Accurate Ore Sampling

THE EDITOR:

Sir—In 1922 I had two articles in *Mining Journal-Press* on "Ore Sampling," jointly with A. C. Halferdahl; and these were followed by discussions extending into 1923. Although this subject has not developed in due proportion to other branches of mining, yet I find it is by no means dead. Growth is one of the evidences of life. The management of a large cement plant has become interested in scientifically accurate sampling of its limerock-shale mixture; and I am directing the design of a new sampling mill for the company operating this plant. It was at first surprising to discover that this material requires more care than any ordinary ore, but the reason was found.

One of our principles shows that a mill with say four sampling stages must use larger lots of ore than one with fewer stages, because each stage involves an independent chance of error. The application of this fact offsets the old argument that where metallurgical reasons demand minimum production of fines, the four-stage mill is better than two or three stages because it discards more ore at coarse sizes. This latter argument is sound enough by itself; but the new principle makes the over-all production of fines in the few-stage mill only the same as in the many-stage plant. The simpler plant saves in both installation and in operating costs.

Colton, Calif.

CHARLES D. DEMOND.

Consultation

Cost Data of Truck Haulage

In response to a request for information regarding the cost of motor-truck haulage which appeared in *Mining Journal-Press* of March 21, Roy H. Clarke, mining engineer of Oakland, Calif., has kindly supplied the following interesting information:

"From an experience of five years in hauling a product 32 miles by autotruck on dirt roads in a semiarid climate through the Coast Mountains of California, the cost to operator has been \$4.90 per ton. This cost also includes a backhaul of 500 lb., making a total haul of 1.25 tons for the above figure.

"The cost is divided into \$4.25 per ton contract price paid to independent truck drivers, owning their own trucks; 50c. per ton unloading into freight car, and 15c. per ton for road maintenance. The road used has three divides, two that rise to 2,600 ft. elevation from an elevation of about 500 ft. at the discharge terminal.

"The cost per ton to autotruck owners can be divided approximately into \$2 for rubber, 60c. gas and oil, and 60c. repairs, a total of \$3.20 or 10c. per ton-mile, leaving a profit of 3.3c. per ton-mile. The mine owners' total cost is 15.3c. per ton-mile.

"The above-named figure is low-cost hauling and is due largely to the fact that the truck drivers always overload (a five-ton truck hauls seven to nine tons) and to the fact that the roadbed is taken care of efficiently.

"The modern speedy five-ton truck is undoubtedly the best vehicle to haul on a dirt road as compared to wagon, caterpillar, or other tractor. The cost of hauling depends on many conditions, among the more important of which are climate, grade of roadbed, its materials and proper maintenance, the length of the haul, and, of course, a steady tonnage to haul.

"In my opinion it is certain that an operator gains by contracting his hauling to outsiders owning their own equipment."

A. J. Rupley, of J. B. & A. J. Rupley, Placerville, Calif., has also added to the discussion by submitting the following data, which are drawn from his experience in handling mining timbers and lagging:

"On the Consultation page of *Mining Journal-Press* of March 21, we note that someone is asking for data regarding transportation on motor trucks, caterpillars, or wagons. We have used all of these different types of equipment, and we find the motor truck the best means of transportation, if the writer expects to let a contract. If he has a fair road he should get this ore hauled for 50c. per ton per mile. If he wants to operate trucks himself, it will cost him approximately \$17.50 per day to operate a truck. If he has steep, rough roads we would recommend nothing but a truck; and, on the other hand, if the writer has fairly good roads and a long haul we would recommend a seven-speed machine, as it is much faster and a little more economical to operate. We have used motor trucks since 1914, and find them very satisfactory.

"As to a narrow-gage railroad, in our country the average cost is from \$15,000 to \$18,000 per mile.

"We are the largest makers of split lagging and narrow-gage railroad ties and mining stulls in California. We have supplied the Phelps Dodge Corpora-

tion's mines in Arizona since 1897 and we are still supplying them."

A rather wide gulf exists between the costs per ton mile given in the two communications, but comparisons should be made guardedly for trucking conditions naturally show wide variations. Unless haulage takes place under identical conditions comparisons cannot be fairly made.

Use of Tungsten Metal and Tungstic Acid

"Please let me know if the use of tungsten metal powder in the manufacture of alloy steel is decreasing. What is tungstic acid used for?"

Producers inform us that the use of tungsten metal powder in the manufacture of tungsten steel is declining. The reason for this tendency is because steel makers find it more satisfactory to use ferrotungsten. It is easier to maintain uniformity in their alloy-steel product with ferrotungsten than with the use of tungsten metal itself, as in ferrotungsten the tungsten is already combined with the iron. A few years ago the use of the metal powder and ferrotungsten was about the same, but recently the consumption of ferrotungsten has outstripped the use of the metal, a situation which is not likely to change.

Tungstic acid (WO_3), is an intermediate product in the production of tungsten metal. It is used by electrical manufacturers in the ammonia soluble form, H_2WO_4 . The advantage in the use of tungsten lies in its resistance to pitting when subjected to repeated electrical discharges. Hence it is in demand in the manufacture of electrical devices for making and breaking contact. Ignition systems of automobiles frequently use tungsten contact points. The metal is also employed in the manufacture of X-ray tube plates and electric lamps, where it has been found more durable than other metals.

Kind of Charcoal Used as a Gold Precipitant

"Observing two articles referring to charcoal precipitation of gold from cyanide solution, I would like to know if you can inform me as to the kind of charcoal suited for this purpose and if there is any preparation prior to running the solution through the charcoal. It seems to be asking a considerable part of your valuable time and if you cannot, without much trouble, answer the questions please refer me to someone who can."

Two articles have been published that cover this subject. One from *Metallurgical and Chemical Engineering* (Vol. 18, p. 642) will give an idea of one method of application of fine untreated char. Another article from *Chemical and Metallurgical Engineering* (Vol. 32, p. 164) discusses the use of an activated char, as proposed by Dr. McKee, of Columbia.

A great many types of ground vegetable and animal char, and activated char, are probably suitable for the purpose; and we suggest that your metallurgist make a few tests with the various classes that can be prepared or are available. The use of a cheap and non-fouling precipitant for the recovery of precious metals in cyanide solution has received scant attention, and little data are available. This has been due in no small measure to the strong position of the distributors of zinc in the form of shavings and dust, and the majority opinion in favor of the continued use of a metal as a precipitant.

We shall be interested to receive any information as to the result of your work in this connection.

News of the Week

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

Summary

THE National Lead Co. has purchased the Metallurgical and Chemical Corporation, which has a plant for producing lead from secondary metals in Matawan, N. J.

The chemical plant at Owens Lake, Calif., has been sold to a corporation which intends to convert it into a custom ore treatment plant.

Several claimants under the War Minerals Relief Act will seek to liberalize the provisions of that legislation.

Nevada mine operators have organized to fight the state bullion tax.

Additional facts will be developed in the Tonopah

Extension-West End Consolidated litigation by actual mining operations.

The Walker Mining Co., of California, is to retire its indebtedness to the International Smelting Co.

The Toric mine, in British Columbia, has opened a 12-ft. vein, and has a promising outlook.

Workmen's compensation rates have been advanced in Ontario.

The Homestake Mining Co. has acquired the Oro Hondo, in the Black Hills.

Phelps Dodge Corporation has centralized its safety work.

Belgians Seeking Idaho Zinc Concentrates

Deal With Tamarack & Custer Rumored
—Vielle Montagne Company
in Market

Representatives of the Vielle-Montagne Zinc company of Chenée, Belgium, recently arrived at Wallace, Idaho, and spent a week investigating the zinc situation in the Cœur d'Alene district, and were prepared to enter into contracts for the purchase of zinc concentrates for shipment to the plant in Belgium. These representatives were M. Chaplain, engineer, and T. Nivette, both residing in Belgium, and H. Salinger, of San Francisco, representing the Duvall-Moore company, ore exporters, of that city. These gentlemen conferred with all the large operators of the district who are producers of zinc ores, and were anxious to close contracts for their entire products. What success they had has not yet been disclosed, although it is unofficially stated that they secured a contract for the zinc product of the Tamarack & Custer company, controlled by the Days, and if this is correct it probably means that the Belgians also secured the product of the Success company, which is under the same control.

Practically all the zinc produced in the Cœur d'Alene district now goes to the Anaconda plant at Great Falls. The entrance of the Belgians into the Cœur d'Alene field is explained in the fact that they have been deprived of their former source of zinc supply in Australia, the entire product of the mines of that country now being taken by smelters erected in England since the war; hence they must look to the

United States for zinc concentrates in the future. Shipments from the Cœur d'Alene would go to Portland and from there by water by way of the Panama Canal. The Belgians claim to have a freight rate, in spite of the long distance, which will enable them to compete successfully with American zinc reduction works. Zinc production in the Cœur d'Alene district has been held down on account of the disadvantage of the long haul to the zinc smelters of the Middle West and East, although this situation has been relieved somewhat by the Anaconda plant at Great Falls.

Homestake Mining Co. Buys the Oro Hondo Mine in the Black Hills

A transaction has been completed whereby the Homestake Mining Co., at Lead, S. D., becomes the owner of the Oro Hondo mine. This property is directly south of the company's present holdings, and the Oro Hondo shaft is 1,600 ft. south from the Ellison shaft of the Homestake company. The Oro Hondo property has been opened to a depth of 2,300 ft. by a three-compartment shaft. Recent developments at the property extended over a period of three years, but all work was suspended in 1917. Mr. Milliken, of St. Louis, purchased the property, after several years of development, which consisted in the sinking of the shaft to its present depth from a depth of 1,000 ft. In addition, diamond drills were extensively used and the mine was thoroughly prospected from the various levels. Mr. Milliken died some years ago, and the executors of his estate have now disposed of the property.

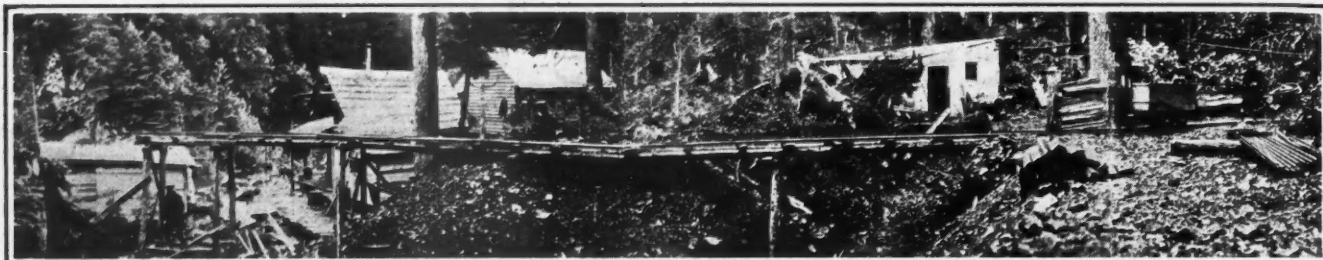
National Lead Purchases Metallurgical and Chemical Corp.

Rights to Harris Process of Refining and Reclaiming Metals Acquired
—Consideration Not Made Public

On April 6 the National Lead Co. bought the Metallurgical and Chemical Corporation, an organization manufacturing lead from secondary metals. The sum paid, or consideration given, was not made public. By this purchase the National Lead Co. takes over the rights to the use of the Harris process of refining and reclaiming metals which the Metallurgical and Chemical Corporation controlled. The National Lead Co. intends to experiment with this process and to develop it further. Through its use it is possible to utilize scrap lead for the production of antimonial and soft refined lead of a high quality. The Metallurgical and Chemical Corporation's plant is located at Matawan, in New Jersey.

Nevada Mine Operators to Fight Bullion Tax Ruling

The Nevada Mine Operators' Association has decided to carry the case of Nevada State Tax Commission vs. Tonopah Extension Mining Co., concerning permissible bullion tax statement deductions, to a higher court. This case was heard before Judge Dunn, of Tonopah, and was decided against the mining company, the court denying the right to deduct such items as depreciation, taxes, insurance, construction, and certain outside the state office expenses in computing bullion tax. Under the ruling only the actual cost of bullion production may be deducted.



Camp at the Toric mine, in the Alice Arm district in British Columbia

Wide Vein of \$12 Ore Opened in Toric Mine

Values in Native Silver—Metal Cannot Be Floated, but Will Amalgamate—Mill Planned

A VEIN of gold-silver ore 65 feet long, containing $\frac{1}{2}$ oz. of gold and 12 oz. of silver per ton, is being developed by the Consolidated Homestake Mining & Development Co. at the Toric mine, in British Columbia, according to A. C. H. Gerhardi, who has just sailed from New York for London. Mr. Gerhardi, who is managing director of the company, makes his headquarters in British Columbia, but is now going to London for the purpose of financing the construction of a mill. He estimates the reasonably assured ore reserve to be not less than 256,000 tons containing \$12 per ton in gold and silver.

Flotation tests made in Seattle have demonstrated the fact that the ore cannot be treated effectively by flotation, because most of the silver occurs in metallic form, and the heavy flakes are not readily floated. However, it is possible, according to Mr. Gerhardi, to recover at least 90 per cent of the precious-metal content by straight amalgamation, and his plan is to erect a plant of this character with 50 tons' daily capacity during the coming summer.

The property consists of 97.85 acres, giving a length of 2,700 ft. along the lode. It is situated $17\frac{1}{4}$ miles from tidewater, at Alice Arm, and the workings are within 3,000 ft. of the widely if not too well-known Dolly Varden mine. The Dolly Varden 36-in. gage railway reaches to a point within three-fourths of a mile from the Toric camp, and the Homestake company operates light trains over the tracks. Gasoline speeders of which the essential part is a Ford engine serve as locomotives to pull trailers. Freight is hauled for \$0.075 per pound. One of the locomotives is shown in the accompanying illustration.

The ore deposit is associated with prominent barite quartzose dikes and fissures, frequently intermixed with jasperoid. The lode dips at 45 deg. to the north. As revealed in the main crosscut tunnel, it consists of bluish-white quartz, with bands of jasper, barite, and calcite. The ore minerals are ruby silver, fine steel galena, pyrite, chalcopryite, gold—and, principally, native silver. In addition to the main tunnel the lode has been developed by a footwall drift and a second crosscut; and a third crosscut is being driven.

A portable Sullivan gasoline-driven

compressor, shown in the accompanying illustration, supplies power for development. The average total cost of cross-cutting and drifting has been less than \$13 per foot, the work being done on contract at \$9.50 per foot. The contractors pay for powder at \$15.50 per 50-lb. case, fuse at \$1.25 per hundred, caps at \$2 per hundred, and carbide at 40c. per day. The miners are charged \$1.40 per day for board and lodging. The \$13 is a direct operating cost to which should be added \$1.50 per foot for superintendence and overhead.

Operating costs, according to the estimate of Mr. Gerhardi, will be \$2.30 per ton for mining in shrinkage stops and \$1.70 per ton for milling.

Marble Quarries Sold

At Sonora, Calif., a deed was recently recorded transferring the Bell Marble company's quarry at Columbia near Sonora to the newly incorporated Bell-Columbia Marble Co. The consideration is said to have been \$200,000.



The Inspector of Mines and A. C. H. Gerhardi, manager of the Toric

C. & H. Heading for Wolverine Boundary

Retimbering Burned Areas and Reconditioning Shaft—New Railroad Will Serve Kearsarge Lode Mines

Calumet & Hecla Consolidated, in the Michigan copper district, is preparing to mine the territory under Wolverine, which returned a yield as high as 25 to 26 lb. of refined copper per ton in the deepest levels before Wolverine's life at depth was terminated by boundary limitations. The 38th level, south, is well into this territory, and five other drifts are heading in that direction. Stopping is under way in the 34th level south. The shaft is bottomed below the 43d level. It was down 4,764 ft. the first of the year, and sinking continues. Though openings to the north of the shaft have exposed poor ground, those to the south are good. North Kearsarge is shipping enough rock to keep one stamp head in the Ahmeek mill busy. This tonnage will be increased as openings are extended to the south and stoping ground becomes available.

In Calumet & Hecla's No. 4 shaft, on the conglomerate lode, steady progress is being made in retimbering the burned areas between the 51st and 72d levels, but several months more will be required to recondition the shaft. The deepest levels, untouched by the fire, are available for mining. An immense tonnage remains to be taken from No. 4 shaft in backs of stopes and pillars from the bottom levels upward. No. 2 shaft is again in operation, hoisting rock from levels above the 20th. On the Osceola lode, No. 14 shaft, recently reopened, is shipping about 1,000 tons daily.

The new Ahmeek railroad, which is scheduled for completion in July, will serve not only Ahmeek but all of the Kearsarge lode mines of Calumet & Hecla Consolidated, which has acquired the Mineral Range tracks to the Kearsarge and Centennial properties.

Germans Get Concessions to Turkish Copper Mines

News from Berlin is to the effect that the Turkish Government has just granted a concession to the well-known German firm of Holzmann & Co., of Frankfurt-on-the-Main, for the exploitation of the copper mines at Arghana-Maden. This concession had previously been promised to a French concern. At the same time concessions for the construction of Turkish ports were granted to Dutch firms.

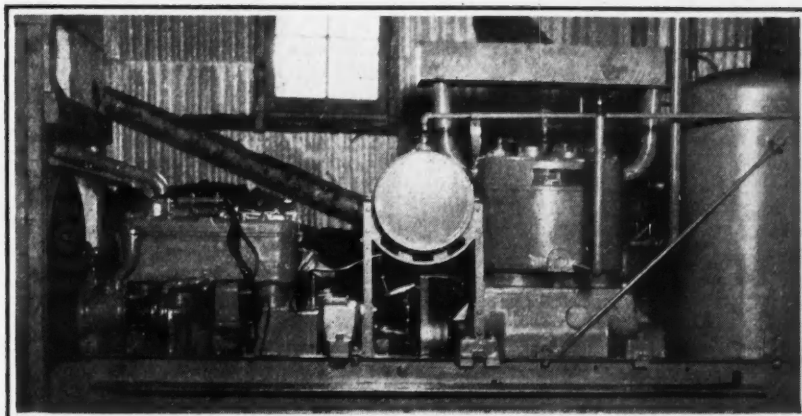
**Charges and Countercharges Fly
in the Bingo Case**

The preliminary investigation of the charges of fraud against Joseph Myers, manager of the Bingo gold mine, of northern Manitoba, was resumed in the Winnipeg Police Court on April 6. Two sample sacks which had been used as pockets in miners' overalls and were alleged to show traces of having held gold filings, were produced as exhibits. R. A. Bonnar, K. C., counsel for the defense, declared that the charges against Myers were engineered by American capitalists with a view to frightening British interests out of the field and obtaining control of the Bingo mine for nothing. L. Chamberlain, geologist and mineralogist, testified to having found traces of gold filings in the bag used as a hip pocket in the overalls of Kennedy, the superintendent of the Bingo, as well as in other bags that were found in the storehouse at the mine.

On April 7, Mr. Chamberlain was subjected to a long cross-examination with the object of showing that the traces of gold filings found in the sacks might have been due to the panning of gold by miners or the carrying of samples from which gold might rub off. He said that there was 10,000 or 12,000 tons of rock on the Bingo dump, from the grinding of which the truth about the mine could be demonstrated. Mr. Bonnar said that if the prosecution would permit, Myers was prepared to erect a mill and mill the rock. R. B. Graham, crown prosecutor, replied that the prosecution had no authority to give permission to the company for the erection of a mill.

**Investigating Short Railroad
for Hyder**

A syndicate composed of Seattle and Hyder, Alaska, capitalists has engineers in the field to investigate the practicability of a railway from Hyder to the British Columbia boundary, a distance of 13 miles. It is stated that if the railway is constructed the Premier Gold Mining Co. has guaranteed to provide an average of 500 tons of freight per day. The railway would serve several embryo mines and the Riverside, which is turning out about 15 tons of concentrates per day. A report is expected in the near future.



Gasoline-driven compressor plant at the Toric mine



One of the locomotives used to haul supplies over the Dolly Varden narrow-gauge railroad

**Strike Near Bishop Causes
Influx of Prospectors**

**Activity Stimulated in Surrounding
Areas**

Fifty miles north of Bishop, Calif., just over the state line in Mineral County, Nev., but in a region tributary to the Owens River Valley of California, a reported discovery of gold is creating considerable excitement.

Thus far approximately 50 tons of the product of the mine workings, minus all ore showing free gold, which is sorted out and sacked, has been placed on the dump, and it is estimated that the entire lot will average better than \$150 a ton.

The discovery property is known as the Golden Gate group and is comprised of four claims, or about 80 acres. It is owned by D. E. Lutz, a merchant of Bishop, and Al Stevens, a prospector. The discovery was made by Mr. Stevens and J. F. Van Every, who are operating the property under an eighteen-months' lease, with Mrs. Pearl Smith, formerly of Pasadena, as their financial backer and partner. Although the Owens River Valley branch of the Southern Pacific R.R. runs across the southern end of the property, the leasers announce that they will not ship their ores to the smelters. Instead, they intend to treat them themselves in a Huntington mill of 12-ton daily capacity, which they are erecting near their leasehold. As their lease expires next August, they are

hurrying completion of the new plant.

As news of the strike spreads, the influx of mining men and prospectors increases. Claims have already been staked for 5 miles in all directions from the discovery property. As no accommodations are available near the new find, the fortune-seekers arriving in daily increasing numbers are making their headquarters in Bishop.

On the Gold Wedge property, 30 miles north of Bishop, Joseph Main has opened up a 4-ft. vein of ore that gives average assays of better than \$50 a ton in silver and gold for its entire width. He has extracted 100 tons of ore, which will, it is said, soon be shipped to the smelter.

**To Develop Additional Facts in
Tonopah Extension-West
End Litigation**

**Defendant Company Will Perform the
Necessary Work**

In connection with the apex litigation between Tonopah Extension, plaintiff, and the West End Consolidated Mining Co. and affiliated companies, defendants, covering apex rights to the "76" vein discovered over a year ago by the West End in leased Tonopah "76" territory, a stipulation was entered into on April 4 which provides for development work and ore mining. The defendant will resume work in a winze on the vein into Tonopah Extension territory, and a raise will be started from the plaintiff's 1,200 level which will connect to the bottom of the winze. This work will develop facts regarding continuity of the vein from the West End 800 level to the Tonopah Extension 1,200 level, a distance on the vein of more than 500 ft.

In addition, the stipulation provides that the plaintiff company may mine ore in the vein both above and below its 1,200 level, within certain defined limits, the defendant to have the privilege of checking weights and assays and the plaintiff to furnish monthly statements to the defendant of ore shipped under this stipulation.

The defendant company will file an amended answer before June 1, and the case is set for trial in Goldfield on or about Oct. 12, 1925.

Toronto Letter

By Our Special Correspondent for
Northern Ontario

Ontario Workmen's Compensation Rates Advanced

Deficit in Fund Increases Tax—Mining Corporation to Investigate New Territory

The new rates issued by the Workmen's Compensation Board for Ontario show decided increases, particularly for gold and nickel-copper mining. The rate for gold mining has been adjusted for 1924, on the basis of \$4 per \$100 of payroll, compared with the provisional rate of \$2.40, and nickel-copper mining has been raised from \$2.75 to \$4. The \$4 rate in both cases is the provisional rate for 1925.

The Workmen's Compensation Commission is a department of the Ontario Government, the mining companies contributing all the funds. Persons engaged in the mining industry who suffer from accidents which incapacitate them for seven days or longer receive compensation at the rate of two-thirds of their wages. Provision is also made for the payment of substantial compensation to the dependent families of workmen who are killed or incapacitated, and the amounts necessary for this are capitalized, the full assessment being charged against the year in which such accidents occur. During the last two years the Ontario mines have had a bad accident record, particularly of non-fatal accidents resulting in total disability. In the last year there was also a large increase in the number of accidents through the use of explosives, and in an analysis of twenty-three blasting accidents, the Mining Inspector points out that eighteen were due to the fault of the workmen and that, of these eighteen, fourteen were caused by foreigners.

Mining, with some other industries, is grouped in Class 5, and the total deficit in Class 5, for the last year, was \$159,000. The deficit in 1923, carried forward to 1924, was \$70,000, making a total of \$229,000 to be made up in 1924. When the deficit or surplus of any particular class is not a large amount, the rates are not changed, but if there is a serious deficit the rates are adjusted to take care of it.

Monthly Production Statements Desired

The directors of the Nipissing mine, of Cobalt, have declared the regular quarterly dividend of 3 per cent, payable on April 20. The company will in the future issue quarterly reports of production, instead of monthly reports, the last monthly report being for January, and it is understood that production for the first quarter of the year will show a considerable decrease, compared with that of 1924.

There is a growing feeling that the mines, and particularly the gold mines, should issue monthly statements of the tonnage crushed and the production. It is perhaps too much to ask that costs for the month should be given as well, but it is felt the issuance of monthly production figures by all the mines

Mexico's Metal Production Greater in 1924

THE official figures showing production of metals in Mexico for 1924, compared with that for 1923, have just been given out by the Mexican Department of Commerce and Industry. They show an increase of 2 per cent for gold; 7 per cent for silver; 5½ increase on lead, and 2½ for zinc.

	1924, Kilograms	1923, Kilograms
Gold.....	24,647	24,162
Silver.....	8,244,104	2,824,104
Lead.....	164,140,130	155,720,342
Copper.....	49,052,194	53,371,582
Zinc.....	18,936,337	18,481,279

It must be taken into consideration that the de la Huerta revolution at the close of last year seriously affected the mining output for a time. Officials believe that the production for 1925 will greatly exceed last year.

would have a good effect in creating confidence.

The Mining Corporation has negotiated an extension of its lease on the Peterson Lake territory. This extension has been granted in consideration of the Mining Corporation carrying on continuous operations, at considerable increase in speed and expenditure of money. The extension of the agreement will permit the Mining Corporation to undertake work in new territory, which it was formerly impossible to undertake, because of the short term of the lease.

At the annual meeting of the McKinley-Darragh, the board of directors was increased from seven to ten, which is a compromise settlement of the feud which has existed for some time. The president stated that recent operations have entirely changed the complexion of affairs, production being greater and the mill rock of higher grade.

It is announced that the Menago Company will soon resume shipments of mill rock to the Mining Corporation concentrator. Recent production has been high-grade ore, but the company will now ship about 2,000 tons of mill rock per month. In 1924 the total production was 447,000 oz. This company is a subsidiary of the Continental Mines, Ltd., which recently stopped operations in Kirkland. It is probable that further finances are needed, and that after these have been arranged for work will be once more resumed from the bottom of the 800 level.

Dome Output Up

Production of the Dome Mines, of Porcupine, for the quarter ending March 31, shows a recovery of \$1,052,863 from 131,600 tons of ore, averaging \$8 a ton. This production is slightly in excess of the corresponding period in the previous year, and after estimated costs, on the same basis as last year, shows a margin over dividend requirements, which call for \$476,677 for the quarter.

The new shaft of the McIntyre mine has reached a depth of 300 ft., and progress is being made at the rate of

approximately 200 ft. a month. Operations are now becoming well organized, which should result in greater efficiency and speed.

Officials of the New Rhodesian Mines & Investment Co., Ltd., of London, which controls the Porcupine Crown property, say that the mine will not be reopened and that the company will await developments in adjoining mines, in anticipation of a possible opportunity which would result in the Porcupine Crown being taken over.

Walker Mining to Retire Debt to International Smelting Co.

The Walker Mining Co., of California, has made arrangements with the International Smelting Co. whereby part of its earnings will be allotted to dividends, according to official advices from Salt Lake City, headquarters of the Walker company. The company owes approximately \$1,000,000 to the International, and is earning about \$90,000 net, per month.

By the new arrangement the first \$30,000 earned monthly will be applied to the debt, and after the \$100,000 issue of preferred stock has been retired the second \$30,000 can be used for dividends. Any net profit over \$60,000 per month will go to a reserve fund to insure payment of the indebtedness at the stipulated figure, together with interest.

After the preferred stock has been retired, one-half of any excess over \$60,000 per month will be paid on the indebtedness, with the remainder available for dividends or other purposes. The management expects to complete retirement of preferred stock by June 1, 1925.

The property is producing 800 tons of 3 per cent copper ore daily, and turning out approximately 1,300,000 lb. of copper per month.

Retreating Glaciers Aid Prospectors

The Big Five mine, on the north fork of the Lardeau River, near Ferguson, B. C., is the scene of an important strike of high-grade silver lead ore which was made last summer. Owing to the fact that the glaciers of the region retreated further last season than was ever before known, the uncovered area was prospected and there veins were disclosed carrying as high as 5,000 oz. in silver per ton.

A retreating glacier on Sable Creek disclosed a large lead of which float was found several years ago. The half-mile retreat of the glacier revealed the source of the float in a vein said to be 30 ft. wide in which 8 ft. of good shipping ore was revealed on the Cambridge property.

Placer Mining in California

The Oro Fino Hydraulic Mining Co., operating in Scott Valley close to Oro Fino, near Yreka, Calif., is making arrangements to install a scraper and mechanical elevator. The gravel will be raised from bedrock and delivered by the elevator to the washing flume. At Marysville, G. Grayson has taken an

option on 500 acres of the P. George tract on the Marysville-Browns Valley road and on the adjoining tract of 430 acres. It is planned to install and operate a dredge.

C. E. White of Oakland, Calif., has started the installation of a drag-line scraper on placer claims in Chili Gulch south of Mokelumne Hill. At the Royal Drift mine, on Butte Creek, 24 miles northeast of Chico, Butte County, a tunnel has been extended 2,600 ft. toward a suspected channel. At the neighboring mine, the Dix property, a tunnel has been extended 2,500 ft., and local reports indicate that the rim of the channel has been struck.

Phelps Dodge Centralizes Safety Work

To provide for better correlation of safety work and to facilitate thorough discussion of practices at the various branches, the Phelps Dodge Corporation has organized its safety departments under one central committee, to be known as the Phelps Dodge Corporation safety committee. P. G. Beckett, vice-president and general manager, is chairman of the new committee, and Gerald Sherman, consulting engineer of the corporation, is secretary. The other members are G. H. Dowell, manager of the Copper Queen branch; W. G. McBride, general manager of the Old Dominion, at Globe; F. A. Ayer, manager of the Moctezuma branch, at Nacozari, and William Sabin, assistant manager of the Morenci branch. After the corporation committee come the general branch committees, made up of representatives from each division of the various branches, and the division committee, which comprise representatives from the different departments in the divisions.

Though the safety work has heretofore been very satisfactory, officials of the company believe that with the present organization greater co-operation will lead to even more effective work.

Tonopah Output Down in March

March production for the Tonopah mining district in Nevada was slightly below normal. Complete returns are not yet available, but estimated production is 365,000 oz. of bullion, valued at about \$320,000. Tonopah Extension bullion decreased somewhat, owing to the settling of large stopes between the 1,940 and 2,000 levels, resulting in restricted tonnage from this important producing part of the mine. Mill tonnage has temporarily dropped from 500 to 350 tons of ore per day, but will be increased to normal as soon as mine conditions permit.

California Rand Option Lapses

The option taken on the mining property of the California Rand Silver, Inc., at Randsburg, Calif., has not been taken up, as the ore reserves of the mine are said not to have come up to expectations. It is stated that the California Rand will begin a new development program and sink its main shaft an additional 500 ft.

Consolidated Mining & Smelting to Redeem Bonds

Two \$25 Shares Will Be Issued For Each \$100 Represented in Premier Security

Shareholders of the Consolidated Mining & Smelting Co. of Canada, at their annual meeting in Montreal on April 9, unanimously voted to authorize the directors to proceed to convert their approximately \$3,800,000 of 7 per cent bonds. These bonds in the ordinary course of events are redeemable at \$110 and interest after July 1, 1925, and convertible after July 1, 1927. Wishing to husband cash and simultaneously fund all outstanding obligations in the form of bonds and loans, and aiming to extend operations, exceptional financing is to go into effect by mutual concessions.

At the moment, the \$25 shares, bearing 6 per cent, are quoted at \$65. The bonds are closely held by predominant shareholders, who had previously agreed to the funding scheme. For two shares of \$25 parity each, valued in the market at \$130, they will, therefore, surrender \$100 in bonds as and when called on. Nominally, bondholders accept \$50 for \$100; but as a matter of fact, they take shares, on a basis of \$50 each, that are actually worth \$65. But the two shares, with their combined current dividend return of 12 per cent,—until a greater yield is forthcoming—will compensate those who surrender \$100 at 7 per cent in bonds.

As it was the funds provided by bonds and loans secured by bonds that enabled the administration to bring Consolidated enterprises to fruition, the realignment of capitalization was promptly concurred in by shareholders, who understood the advantages to accrue. "Cheap" financing of this sort, by retiring \$3,800,000 in bonds with about \$1,900,000 in stock, was so eminently equitable in its application that there was no dissent. Those who prefer to retain their bonds and await the expiration of the redemption period after July next, at \$110, and convertible after July 1, 1927, have the option of so doing; but the benefits of the immediate proposal are so obvious, that the Consolidated company by midsummer will have outstanding only approximately all of its issued capital of 600,000 shares at \$25 each, besides being in a stronger treasury position, with loans and liens well if not completely liquidated. At least that is the objective outlined by President Warren, who was brief and declined to be drawn into a discussion of the dividend policy.

"During the first quarter of this year," said Mr. Warren, "operations proceeded about as usual. Production was somewhat in excess of that of the same period in 1924. Market prices were more favorable this year than last, though there has been a marked drop from the high levels of December. At Rossland, development is still disappointing. In the other mines, conditions are practically unchanged. Good progress is being made with the plant extensions at both the smelter and Bennington Falls. It is expected that the output for the remainder of the

year will be marketed at fair prices."

Mr. Warren was guarded in his remarks as to dividend distributions, more solicitude being expressed for the maintenance of treasury safeguards against unlooked-for requirements and breaks in metal markets, when the company might have to carry on operations somewhat on its own credit facilities. The point being raised as to whether the company inventories were taken at cost, the president replied in the affirmative. Mr. Goldsmith, of New York, inquired concerning the increase in the item of general expenses and also the grade of ore mined. It was explained that general expenses were governed largely by the volume of business. During 1924 there was no special expenditure other than what was set out in the statements of account. If the grade of ore was lower, that was an economy, and the recovery of metallic contents had increased. Concentrating capacity at Kimberley, it was stated by General Manager Blaylock, who is also a director, is now such that higher-grade ores can be conserved, the larger tonnage of lower grade taken being adequate. This was no fault of the mine at Kimberley. It could not be attributed, as one shareholder erroneously thought, to any falling off in grade. Lower grade now being availed of, and higher extraction, are all-sufficient, according to Mr. Blaylock. Speaking of the old concentrator at Trail, Mr. Warren said it was being reserved for the treatment of what custom ore is proffered.

The directors were re-elected by the votes of 70 per cent of the entire shareholders as follows: H. S. and F. Gordon Osler, S. G. Blaylock, and Henry Joseph for one year, and Mr. Warren, J. K. L. Ross, J. C. Hodgson, Charles R. Hosmer, and W. L. Matthews for two years—rotation in office being decided on so as to preserve continuity of policy.

President Warren brought up the subject of the retirement of the bonds. "We want to get out of debt," he declared. "By converting the bonds in the manner agreed on after consultation, we will have more money for the purposes of the company." The directors had recommended the acceptance of two shares of the common stock in exchange for every \$100 of bonds outstanding, as not unfair to bondholders, giving them a slight margin of profit. By doing this current doubts will be removed and permanent benefit will be derived, financially and physically.

One shareholder alone, with an eye single for increased dividends, demurred to the extent of intimating that the directors are "robbing Peter to pay Paul." Mr. Warren humorously rejoined that he did not know which is "Peter" and which is "Paul." He did not see that "anyone is being robbed. If anyone objected to the terms, we will pay them out according to the trust deed."

Chemical Refining Plant at Owens Lake Sold

Will Be Operated as a Custom Ore Mill
by Newly Formed Corporation—
To Start in May

Impressed by the steadily increasing mining activity in the Owens Lake silver-lead district and the success attending operations on properties recently acquired by them, John L. Steele, J. S. Tremayne, Louis H. Bering, G. C. Terry, T. R. Lombard, and C. L. Larzelere, all of Los Angeles, have determined to provide local means of ore reduction. Accordingly, they have organized the Continental Development & Reduction Corporation, a closed company, under the laws of Delaware, with a capitalization of 30,000 shares of no par value, and purchased from Charles Clark, of New York, son of the late Senator Clark, of Montana, and E. J. Tobin, president of the Hibernian Savings and Loan Association of San Francisco, the potash and soda plant of the Chemical Refining Co. on the edge of Owens Lake, two miles south of the town of Keeler and a short distance from the Natural Soda Products Co.'s works. The plant was erected in 1920 at a cost said to have approximated \$250,000.

The new owners have already begun the work of converting the plant into an ore-leaching works, with John D. Fields as consulting engineer and manager. The present equipment, President Tremayne says, is to be immediately supplemented by the installation of crushers, ball mills, and classifiers, all of which have been purchased and are now in transit. As remodeled, the plant will constitute an initial unit of 250 tons' daily capacity, which will be increased to 1,000 tons by the building of additional units as rapidly as possible. It is officially estimated that the first unit will be placed in operation by May 15 next. Three carloads of heavy timber have arrived on the ground for the erection of ore bins.

Though custom ores will be purchased, the primary purpose of the corporation in establishing the plant is to treat silver-lead ores from the properties of subsidiary companies organized and in process of formation by the same interests.

New Buses Serve Santa Rita, N. M.

The Bennett Motor Co., of Deming and Silver City, N. M., operating auto stage lines between these two towns and including Hanover, Santa Rita, Fort Bayard, and Hurley, has recently provided a twenty-two-passenger Reo bus for service between Silver City and Deming. The new bus is thoroughly up to date, with separate smoking compartment and other conveniences for the passengers, following out the style of the latest California stage buses.

The stage lines operate on a schedule, making it convenient for passengers from the different mining towns of the vicinity to make connections with the main-line railroads at Deming, and also providing for meeting the El Paso-Deming auto stage line bus at Deming.

New Shovels on the Mesabi Range

A. GUTHRIE & CO., which has a contract to strip and load all ore from the Hill Annex mine, at Calumet, Minn., for the Jones & Laughlin Steel Corporation, is planning for a busy season. The company now has four of the 350-ton type shovels in the pit ready for operation and is erecting a new Model 125 Marion, the largest steam machine recently developed, which is equipped with a three-yard bucket and caterpillar tractors. Besides fast operation, this machine can be shifted quickly from clean-up work in the pit to loading ore.

The shipping season opened on the Mesabi range by the Laura mine, at Hibbing, on April 9, when 30 cars were loaded and shipped to Duluth. This mine has opened the shipping season for the last fifteen years and is usually the last to stop shipments in the fall. It is an underground property and works three crews of men.

Washington News

By Paul Wootton
Special Correspondent

Seek Further to Liberalize War Minerals Relief Act

Supreme Court Asked to Reopen Cases
—Claimants May Petition Con-
gress to Act

An application for the rehearing of the two War Minerals cases recently decided will be filed with the Supreme Court of the United States in the near future. Those who believe the War Minerals Act in its present form was intended to cover all losses sustained by those who produced, or prepared to produce, war minerals, feel that they can convince the court that Chief Justice Taft is in error in his opinions handed down in the *Chestatee Pyrites & Chemical Corporation* and *Logan Rives* cases.

It is only on rare instances that the Supreme Court has granted a rehearing after a case has been decided. If a rehearing should be refused in this instance the effort will be carried to Congress, where legislation will be sought to liberalize the act still further.

In the decision in the *Rives* case these sweeping statements are made by the Supreme Court: "There is nothing in the award by the Secretary in the case at bar which would justify characterizing it as arbitrary or capricious or fraudulent or an abuse of discretion. The Secretary's view that it was not just or equitable to include loss by a land purchase within the gratuity of the government as defined by the statute must, therefore, prevail against mandamus."

In the matter of interest on borrowed money, the point involved in the *Chestatee* case, the court held that the allowance or disallowance of that item came

clearly within the purview of the power vested in the Secretary of the Interior. Moreover, he was given the power to decide the matter finally without recourse to the courts.

Despite this sweeping decision other cases pending have not been dropped, and the *Crimora Manganese Corporation*, of Virginia, has started a suit in which the payment of its entire loss, \$487,032.69, is sought.

Because of the appeals which have been made under the act and which must be given consideration, it is probable that the work of the War Minerals Relief Commissioner will be extended through the summer and fall. Since notice has been given that legislation liberalizing the act will be sought at the forthcoming session of Congress, it is probable that the affairs of the commission will not be terminated finally until Congress gives some indication of its intention as to further amendments of the act.

From present indications the War Minerals work could be concluded about Dec. 1 and \$1,000,000 returned to the Treasury. The impression is, however, that the appropriation should not be turned back and the personnel of the commission disbanded until there is evidence that Congress will not view with favor the legislation which will be introduced.

Those who have been engaged in research looking to the larger use of antimony are much disappointed that the political convulsion in China came just at the time that promising prospects were opening for increased use of that element. Though antimony again is coming out of China in considerable volume, it is recognized that this source of supply is likely to be closed at any time, just as was the case six months ago. The prevailing opinion seems to be that China's internal troubles are far from settled.

If, however, tranquillity should be restored, and the continuity of antimony supply assured, it is believed that there will be large substitution of antimony for lead in paints. Those who have been engaged in experimental work of this character have great faith in their ability to use antimony oxide with success. They point out that the British already have demonstrated the commercial possibilities of antimony paint and have built up a definite and increasing market for it.

The success of any plan to substitute antimony for lead, it is admitted, depends on the ability of the Chinese producers to operate without interference in the mining region and to maintain their deliveries at the seaboard.

It is true that the high prices of recent months have brought out production from Bolivia, France, and Argentina, and have caused operators in Mexico to become interested, but it is recognized that these sources cannot be relied upon to furnish antimony at prices which would encourage the substitution program. On the other hand, China has almost inexhaustible resources of antimony. It can be laid down at New York for 5c. per pound and still provide a profit for the pro-

Movies Underground for Miners

THE Oliver Iron Mining Co. has constructed a modern moving-picture theater 250 ft. below surface in the Spruce mine, at Eveleth, Minn., to be used for mine safety work. The theater is complete, with an orchestra pit, several exits, lighting equipment, water fountain, and seats for more than 200 persons.

At the second show for the miners given recently two accordion players furnished the music and an educational film stressing the safety habit was shown. The Oliver Company furnishes these entertainments about once a month for its employees, and they are much enjoyed at the following towns along the range: Eveleth, Virginia, Ely, Chisholm, Hibbing, and Coleraine. Walter Ethier is in charge of the films.

ducer, it is declared. It is being relied upon to relieve the increasing strain on the world's dwindling resources of lead.

Non-ferrous metal specialists in the government service, who never lose sight of the fact that there is only one crop of minerals, feel that the interval which will elapse before the shortage of non-ferrous metals becomes acute is none too long to provide time for the research program which must be conducted to work out problems of substitution.

Iron Cap Appeals Its Case Against Arizona Commercial

The Iron Cap Mining Co., of Globe, Ariz., having been denied a rehearing before the Supreme Court of Arizona of its case against the Arizona Commercial Mining Co., has filed notice of an appeal to the U. S. Supreme Court on a writ of certiorari. The trial of the case in the district court resulted in a verdict in favor of the Iron Cap company and quieted the latter's title to its lode claims. On the appeal of the case to the state supreme court the judgment was modified to the extent that the unexplored and undiscovered bodies of ores in the claims were not included in the judgment. The higher court held that only those ores that had been removed or bodies of ores that were known in extent could be considered and that the court's jurisdiction did not extend over unexplored ore-bodies.

California High-grade Bill Goes to Governor

The Ingram bill, designed to prevent the practice of high-grading gold ores and bullion in California, was passed by the State Senate and Assembly and is now in the hands of Governor Richardson. It is believed that the Governor will approve the bill. Mining interests are supporting the bill, as it has been demonstrated that the theft of gold from mines and mills approximates \$500,000 per annum.

Mexico City Letter

By W. L. Vail
Special Correspondent

A. S. & R. Closes Aguascalientes Smelter

Company's Ores to Be Treated at San Luis Potosi—Much Activity Noted

The most interesting item for mining men during the month is the closing of the American Smelting & Refining Co. smelter at Aguascalientes. Action had been under consideration for some time, owing to the fact that the location is now inconvenient, being a great distance from the main ore supplies, with a consequent heavy freight charge. The smelter, which was one of the first modern ones in Mexico, is also considered out of date and inefficient. The ore supply, which has for years been treated in Aguascalientes, will henceforth go to the new smelter, belonging to the same concern, at San Luis Potosi. Most of the older employees will also be transferred to the last-named city.

The New Nazareno Mexican Mining Corporation has been recently organized, principally with European capital, to operate in Temescaltepec and other districts of the State of Mexico. Work has started on roads from the camps taken over to Toluca, and a new mill is under construction at the Guitarra property. Ores from this district are at present handled at the Presa mill. The ores are principally silver and gold.

A new mill is being constructed at Santa Cruz, district of Rosario, Sinaloa, of 250-ton daily capacity, by the Cia. Metalurgica del Pacifico, W. W. Matthews, manager. Considerable money is also being expended in road work to connect the various properties with the mill.

Jose Reyes Sanches, purporting to represent a big English syndicate, has been recently taking up a large number of options in the State of Michoacan. The properties taken over are mostly gold, silver, copper, and several sulphur deposits.

William Kearney is constructing a new plant between the mining camps of Bacis and Los Reyes, Durango, for treating ores from his own properties and adjacent mines. The installation will cost about \$65,000. The state government of Durango is offering special facilities for mining investors in that state.

The Peñoles company has taken an option on the Cedral property near Muzquiz, Coahuila.

Utah Iron Mine Will Increase Ore Output

Because of the increased demand, the Utah Iron Ore Corporation, which is shipping about 300 tons of ore a day from its property at Desert Mound, near Cedar City, Utah, will increase its capacity to 500 tons daily. The ore is loaded by steam shovel, one shovel handling the present daily output of 300 tons. Stripping of a large area of overburden is under way.

Ray Con. Has New System for Coaling Shovels

A NEW SYSTEM for coaling the shovels at the Chino mines of the Ray Consolidated Copper Co. in Santa Rita is being tried. The tests began the first of the month. A light locomotive crane equipped with a clamshell bucket accompanies a car of coal to the vicinity of the shovel and loads the coal directly from the car into the bunker on the shovel. This has necessitated the removal of the roofs from the coal bunkers, but, if the system proves practical, sliding or hinged roofs will be provided should weather conditions demand. Heretofore the coal has been dumped on stockpiles at different stations in the pits, whence it was hauled to the shovels in wagons and shoveled into the bunkers with hand scoops.

Johannesburg Letter

By John Watson
Special Correspondent

Record Trading on Exchange

Johannesburg, March 10—The following crushing results, from fourteen leading gold-mining companies on the Rand, for the month of February, arranged in order of profits earned, have recently been published:

	Tons Crushed	Revenue or Value £	Costs per Ton Milled s. d.	Estimated Profit £
Government				
Areas.....	149,000	188,142	16 10.2	165,016
New Modder.	115,000	248,221	17 5.0	148,094
Crown Mines.	211,000	277,160	18 8.1	80,137
Modder Deep.	40,800	93,063	15 7.0	61,309
Van Ryn Deep	50,600	110,882	17 10.9	58,062
Springs.....	61,200	115,785	20 8.4	52,438
Brakpan.....	74,500	121,068	19 4.6	48,851
Modder B....	60,500	103,937	20 0.2	43,397
Geduld.....	73,000	108,355	17 10.0	43,130
City Deep....	87,500	140,924	23 5.8	38,182
Robinson Deep	71,500	.....	17 5.0	37,697
New State				
Areas.....	62,000	101,829	21 4.2	35,956
Randfontein				
Estate.....	190,500	201,783	17 10.0	34,696
West Springs.	43,000	68,737	17 8.7	30,635

On the Johannesburg Stock Exchange, during the past week, there has been a record, as regards volume of business, for a considerable period. The greatest excitement has been over Transvaal Consolidated Lands and kindred companies owning mineral rights over farms in the newly discovered platinum area to the north of Lydenburg. The Stock Exchange gallery has become a favorite visiting place for ladies.

Another Strike in the Slocan

Clarence Cunningham has made an important strike at the Wonderful mine, in the Slocan district of British Columbia. Five feet of good milling ore has been struck on the 700 level. There is 125 ft. of virgin ground between the new strike and the level above. Ten inches of clean lead-zinc sulphides has been struck on No. 6 level of the Bosun mine, in the same district.

Societies, Addresses, and Reports

U. S. Chamber of Commerce Will Meet May 20-22

Many current economic problems which at present are being given attention by both government and business will come before the thirteenth annual meeting of the U. S. Chamber of Commerce to be held in Washington May 20 to 22. Questions to be discussed are international as well as domestic in scope. Among the subjects are: Commercial treaties; the European situation and the future of the Dawes plan; competition in foreign trade; the agricultural situation; the American merchant marine and "Congress and the American Business."

A feature of the meeting will be the formal dedication of the Chamber's new headquarters building.

Much of the discussion at the annual meeting of the Chamber will take place in group sessions. These groups, eight in number, are organized to represent the main divisions of American business enterprise. They are: Natural resources, production, transportation and communication, finance, insurance, manufacture, distribution, foreign trade, and civic development.

Freight Rates Investigation To Be Thorough

The mining industry will be represented by the American Mining Congress in the forthcoming investigation of adjustment of freight rates by the Interstate Commerce Commission. This investigation will cover all rates, charges and classifications, regulations and practices bearing on the transportation of all kinds and classes of traffic. The mining industry is estimated to furnish 53 per cent of railroad tonnage.

Data Sheets on Industrial Poisons To Be Published

A series of data sheets on common industrial poisons is to be issued under the supervision of the Industrial Poisons Committee of the Chemical Section, National Safety Council. These sheets will be published for general distribution. At the Louisville Congress this committee made the proposal to publish from time to time the latest available information on poisonous substances used in industry, in the form of a separate data sheet for each substance.

The list of substances for which the tentative data sheets have been prepared includes aniline, arsenic, benzol, carbon bisulphide, carbon monoxide, chlorine, chromium, hydrogen sulphide, lead, manganese, nitrous fumes, phosphorus, toluol, and picric acid. The data sheets outline not only the mechanical forms of exposure to the material and the characteristic medical symptoms, but also general preventive methods or precautions to minimize the danger. Another feature of practical value is the advice given on special training or emergency equipment to meet any acute exposure that may result from accidental leakage, repair work in tanks, and the like.

Fellowships at Reno, Pittsburgh, and Moscow, Idaho

In addition to the list of graduate fellowships in mining, metallurgy, and chemical research recently announced as being offered by eight prominent institutions of learning in various states, in co-operation with the U. S. Bureau of Mines, the following supplemental announcement is made:

The Mackay School of Mines of the University of Nevada, at Reno, Nev., offers a fellowship open to graduates of American mining colleges of recognized standing. The income of the fellowship is \$750 per year, payable monthly. This fellow will be assigned to research work in co-operation with the Rare and Precious Metals Experiment Station of the Bureau of Mines, at Reno, the research problem to be named definitely at the time that he is appointed. Funds for this fellowship have been provided by John Armstrong Chaloner, who has agreed to place sufficient money in trust to make the fellowship perpetual.

Research to be undertaken by the fellows to be appointed by the School of Mines of the University of Idaho, Moscow, Idaho, to work in co-operation with the federal Bureau of Mines and the Idaho Bureau of Mines and Geology during the school year 1925-26 will probably relate to the following-named subjects: Research on classification of crushed ore; studies in table concentration; Idaho ore problems; and flotation investigations. These fellowships are open to college graduates who have had good training in mining, metallurgy, or chemistry, and who are qualified to undertake research work. The net income of each fellowship over and above all university fees and deposits is \$60 a month for ten months, beginning Sept. 1, 1925.

The Carnegie Institute of Technology, at Pittsburgh, Pa., in co-operation with the Pittsburgh Experiment Station of the Bureau of Mines and an Advisory Board composed of men prominent and active in the metallurgical industry of the Pittsburgh district, offers four research fellowships in metallurgy. Each fellowship yields \$750, paid in ten monthly installments. Fellowship holders will take an active part in the metallurgical research work at the Bureau of Mines. The research problems will be selected by a committee of representatives from the Advisory Board, the Bureau of Mines, and the Institute.

Quebec Engineers Hold Annual Meeting

At the annual meeting of the Corporation of Professional Engineers of the Province of Quebec at Montreal on March 25 the following officers were elected: President, A. R. Decary; vice-president, K. B. Thornton; honorary secretary - treasurer, Frederick B. Brown; councilors, O. Lefebvre, J. M. Robertson, J. M. R. Fairbairn, A. B. Normandin, and Alexander Fraser. The membership of the corporation numbers 984.

Japan and Russia Unite on Metric Standards

The new economic treaty between Japan and Russia directs attention to the recent adoption by both countries of the decimal metric weights and measures, bringing them into commercial conformity with the other nations that use the world standards. The Japanese Government has staged demonstrations of the new units throughout the empire, as part of a nation-wide campaign to popularize the metric standards. So effective has this been that the Weights and Measures Association of Japan announces that progress is being achieved everywhere rapidly and without friction. Japan took up the world decimal standards after a commercial and technical commission of 100 members reported unanimously therefor, and against the unstandardized English measures sometimes proposed for adoption.

Russia also has rejected the old measures and its industries are changing over to the metric basis. The railways and the textile, leather, tobacco, oil, chemical and wholesale grocery trades have pioneered the metric advance, with the electrical industry now beginning the transition. The "Commercial and Industrial Gazette" of Moscow records the placing of retail-selling apparatus on the metric basis, especially in Leningrad, Moscow, and Nizhni-Novgorod, leading commercial centers.

Old Russian measures already have been replaced by the decimal metric units in Poland, Finland, Latvia, Esthonia, Lithuania, and other parts of the former Russian domain.

New Mexico Students in Field

The 1925 senior class of the New Mexico School of Mines left Socorro, N. M., on April 17 on the annual inspection tour of the mines, mills, and points of geological interest in the Southwest. The class is in charge of E. H. Wells, president and professor of geology, and A. S. Walter, professor of mining and metallurgy.

Canadian Engineering Standards Association Active

In a review of the work of the Canadian Engineering Standards Association for 1924 it is noted that there are now fifty-five working committees, numbering more than 400 members. During the year, six new publications were issued, making the total of the Canadian standards seventeen in number.

The organization of the Canadian Committee provides for only seven sectional committees, each of which is charged with supervision over rather a large field of industry, somewhat analogous to the correlating committees for safety codes and for mining projects which function in the American Engineering Standards Committee work. The sectional committees as now organized are as follows: Civil engineering and construction; mechanical; electrical; automotive; railway; ferrous metals; and mining.

Men You Should Know About

W. H. Blackburn, mining engineer, announces removal of his office to Room 924, Crocker Building, San Francisco.

H. D. Budelman has returned to Tonopah, Nev., after a two months' vacation trip to the Hawaiian Islands.

R. V. Hanrahan was elected president of the Humble Pipe Line Co. at a recent meeting of the board of directors.

Colonel Henry H. Armstead of Kaslo, B. C., is in New York and expects to remain for two weeks on professional business.

I. R. Gentry is now in charge of the operation of the Standard Minerals Co., in California, succeeding **A. H. Simpson**, resigned.

H. W. Hardinge, Sr., president of the Hardinge Company, who had been in Europe on company business for six weeks, has returned to New York.

F. B. Weeks, mining geologist, who is interested in the Calico district, San Bernardino County, Calif., was recently in San Francisco to make purchases of mining machinery.

G. A. Joslin, for two years at the Chile Copper mine in Chile, has returned to New York, accompanied by Mrs. Joslin, after a two months' tour of South America.

Dr. Ralph W. Cheney, of the museum of paleontology, University of California, will accompany the expedition of Roy Chapman Andrews, now moving into the Gobi Desert.

H. C. O. Clarke, petroleum engineer, of the U. S. Bureau of Mines, with headquarters at Dallas, Tex., has resigned to accept a similar position with the Humphreys-Boyd Oil Co.

Reginald Dempster, mining engineer of Baker, Ore., was in New York last week for a few days on his way back to Oregon. He had arrived from a trip to Ecuador on a mine examination.

E. R. Bennett, general superintendent of the Rochester Silver Corporation, Rochester, Nev., has returned to Rochester from a vacation and will direct the development operations of the company.

Thomas S. Woods, of Boston, president of the Franklin and Winona companies, is in the Michigan copper district inspecting progress of the work in the new Franklin shaft going down in the Kearsarge vein.

Arthur Wade, geologist, who is investigating the oil possibilities of Australia for the Commonwealth Government, has returned to Melbourne from Queensland, after a three months' tour in that state.

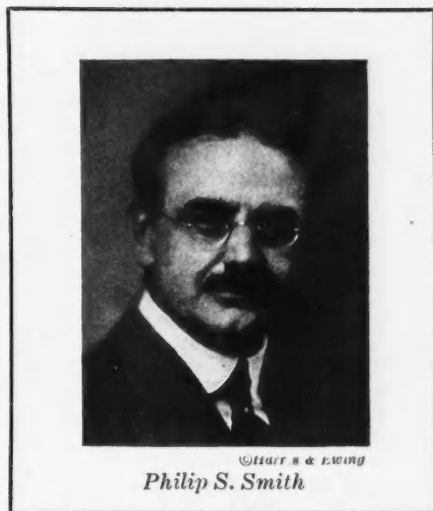
W. H. Corbould, managing director of the Mount Isa Mines, Ltd., has returned to Queensland, Australia, from London, where he spent several weeks in connection with the financial affairs of that company.

Dr. Joseph T. Singewald, who is professor of economic geology at Johns Hopkins University, has received a leave of absence from the university to undertake the exploration of geological formations in South America.

H. S. Munroe announces his retirement as vice-president and general manager of the Granby Consolidated Mining, Smelting & Power Co., Ltd., operating at Anyox, B. C., on May 1. He will spend the rest of the year in travel.

Otto E. Schiffner, mine superintendent for the Rescue Eula Mining Co., has been appointed manager of that company. Mr. Schiffner is well known in Tonopah and is acquainted with local mining conditions, and his appointment has received general approval.

Philip S. Smith became chief Alaskan geologist for the U. S. Geological Survey on April 1. He succeeds to the vacancy created by the death of Alfred



Staff & Living
Philip S. Smith

L. Brooks. Dr. Smith has been engaged in geological work in Alaska for many years, and last year added to his list of accomplishments a particularly meritorious piece of work in a survey of the petroleum reserve on the Arctic slope.

Leo J. Slonim was in Houston, Tex., recently making investigations regarding the use of electrical equipment in the Gulf Coastal oil fields. Mr. Slonim is a special representative of the Russian Government, sent to America by the government oil trust, "Azneft," to make a study of electrical power as applied to oil fields.

James W. Neill, mining engineer, of Pasadena, Calif., recently returned from Japan, where he has been engaged in developing a large deposit of iron ore by means of shafts and drill holes. A Union Construction company's drill was used for the work, which required 1,600 ft. of drilling and 2,000 ft. of shaft work. The deposit is to be exploited by Japanese interests and is in the northern part of the main island near Kujii.

Donald G. Miller, representing the Girard interests in the State of Oaxaca, Mexico, has returned from a trip of two months' duration to New York and other points in the United States, and has resumed work on the dewatering of the San José Garzona mine, near Ocotlán. It is reported that Mr. Miller has denounced something like 300 per-

tenencias of mining ground in the Sierra Juárez in the immediate vicinity of the Natividad mine.

Arthur G. Burrows, Associate Provincial Geologist of Ontario, has been appointed Provincial Geologist in succession to the late Dr. Willet G. Miller. Mr. Burrows was graduated from Queens University, Kingston, Ont., in 1900, and was awarded the medal in mineralogy and the following year was accorded the medal in geology. In 1901 he was appointed Provincial Assayer, a position which he held until 1907, when he joined the geological staff of the Department of Mines. His geological reports on South Lorrain, Gowganda, Porcupine, Matachewan, and Kirkland Lake are valuable contributions to the information available concerning the mineral resources of northern Ontario. Mr. Burrows is a member of the Canadian Institute of Mining and Metallurgy, a Fellow of the Royal Society of Canada, and a member of the American Society of Economic Geologists.

Obituary

Oliver Ryden, assistant underground foreman for the Miami Copper Co., died at his home in Miami on April 4. He was a native of Sweden and was fifty-five years old.

C. G. Buchanan, president of the C. G. Buchanan Co., Inc., of New York, died at his home at East Orange, N. J., on April 9, in his sixty-ninth year. Mr. Buchanan had specialized in crushing equipment and the separation of magnetic iron ores for the last forty-five years. He was a member of the A.I.M.E., the American Iron and Steel Institute and the Franklin Institute.

Oliver Lawrence Garrison, seventy-six years old, president of the Pilot Knob Ore Co., died at his home, The Oaks, in Brentmoor Park, St. Louis County, Mo., on April 6. Mr. Garrison was treasurer of the Missouri Pacific R.R. when his father was president of that road. Later he became secretary and treasurer of the St. Louis Ore & Steel Co. When that company was succeeded by the Big Muddy Coal & Iron Co. he became president. The Pilot Knob Ore Co. is the successor of the Big Muddy company.

John E. Hardman, mining engineer, of Montreal, died on April 3, in his sixty-ninth year. He was born in Lowell, Mass., and educated at the Boston School of Technology. For many years he practiced his profession in the Maritime Provinces and was interested in the gold-mining industry of Nova Scotia. He came to Montreal in 1894, and was appointed lecturer in mining at McGill University, afterward practicing as consulting engineer. He was at one time president of the Mining Society of Nova Scotia and was a charter member of the Canadian Mining Institute, serving for a term as president. Mr. Hardman was also a member of the Canadian Society of Civil Engineers, and the A.I.M.E. He was one of the founders of the *Canadian Mining Review* and had written extensively on mining and on technical subjects of interest to the industry.

Recent Technical Publications

Reviews, Abstracts, and References

General Metallurgy

Métallurgie des Métaux autres que le Fer. Second edition. By Eug. Prost. Librairie Polytechnique Ch. Béranger, Paris, France.

Much progress has been made in metallurgy since Professor Prost's book was first published, in 1912, and in the new edition this progress is well reported. A great deal of the advance has been made in North America, so that a French author is obliged to depend to a large extent on second-hand information, but in this instance the literature appears to have been well combed.

No American book on metallurgy covers the ground that this does in its 1,250 pages. Separate treatment is given of the following metals: Zinc, 230 pages; cadmium, 8; lead, 182; silver, 38; gold, 130; copper, 280; nickel, 54; cobalt, 12; tin, 52; quicksilver, 36; antimony, 32; bismuth, 16; aluminum, 50; magnesium, 8; platinum, 16; manganese, 12; chromium, 12; tungsten, 16; molybdenum, 10; vanadium, 12; and titanium, 7 pages. The information given must of necessity be rather elementary, as the author points out in his introduction. "Je n'ai nullement la prétention d'avoir écrit un 'Traité.' Dans une matière aussi complexe que celle qui est en cause ici, un Traité ne peut se concevoir sans la collaboration d'un certain nombre de spécialistes des diverses branches de la métallurgie."

Those who read French will find this an excellent reference work, and it should be on the shelf of every well-equipped technical library.

A Chapter in American Education. By Ray Palmer Baker. Charles Scribner's Sons, New York.

This little book is a sketch of the accomplishments of the Rensselaer Polytechnic Institute between 1824 and 1924. This is said to be the oldest school of science and engineering in any English-speaking country, and a pioneer in the development of mining engineering. Edward P. Rothwell, of the class of 1858, was one of the former editors of the *Engineering and Mining Journal*, and the founder of the American Institute of Mining Engineers. The institution has reason to be proud of its pioneer work in the cause of scientific education, the story of which is so well related by Dr. Baker.

European Currency and Finance. By John Parke Young. Serial 9, Vol. 1, of the Commission of Gold and Silver Inquiry, United States Senate.

This voluminous report is replete with information about the currency systems of Europe. It is a well prepared and valuable work on the subject. In fact it is more thorough, in some respects, than many textbooks that have been published privately on the subject. One of the most interesting and instructive features of the work is Part II, which consists of short contributions from specialists in financial problems,

among whom the names of Fisher, Jenks, Kemmerer, Kent, Seligman, Robinson, Keynes, Leaf, Willis, Schacht, Cassel, Withers, and many others are found. For the student of currency problems, which is what the Commission of Gold and Silver Inquiry must be, the bulletin marshals an imposing array of fact and opinion that will be exceedingly useful to the conduct of its work. F. E. WORMSER.

Mississippi Bauxite—Bulletin 750-G, 45 pages, obtainable on request from the U. S. Geological Survey, Washington, D. C., discusses "Bauxite in Northeastern Mississippi." It is by Ernest F. Burchard. Another bulletin on the bauxite deposits of this state, with a general discussion of bauxite, its occurrence throughout the world, and the technology of its analysis, mining, preparation, and uses, was published as Mississippi Geological Survey Bulletin No. 19, 208 pages, about a year ago. Obtainable from the Survey at Jackson, Miss.

Homestake Geology—Bulletin 765 of the U. S. Geological Survey, 58 pages, by Sidney Paige, obtainable for 20c. from the Superintendent of Documents, Washington, D. C., describes the geology of the region around Lead, S. D., and its bearing on the Homestake orebody. The bulletin is the result of field work done five years ago.

California Petroleum—"Geology and Oil Resources of a part of Los Angeles and Ventura Counties, California," by William S. W. Kew, has been published by the U. S. Geological Survey as Bulletin 753, 202 pages. Numerous maps and charts are included. Obtainable for 50c. from the Superintendent of Documents, Washington, D. C.

Geological Survey—The forty-fifth annual report of the U. S. Geological Survey for the fiscal year ended June 30, 1924, 83 pages, is available on request from the U. S. Geological Survey, Washington, D. C.

Briquetting Zinc Ores—B. M. O'Harra, metallurgist of the Mississippi Valley Station of the U. S. Bureau of Mines, has published a bulletin on the briquetting of zinc ores, 67 pages. The first part of the paper is a history of zinc-ore briquetting, followed by a chapter on the technology of briquetting in general, and then a discussion of the applicability of various methods of briquetting to the briquetting of zinc ores. Copies may be obtained from the School of Mines and Metallurgy, Rolla, Mo., on request.

Geology—"Base Exchange in Ground Water by Silicates, as illustrated in Montana," is discussed by B. Coleman Renick in Water-supply Paper 520-D, 20 pages, obtainable on request from the U. S. Geological Survey, Washington, D. C.

Canadian Mining—The report of the Canadian Department of Mines for the

fiscal year ending March 31, 1924, 71 pages, has recently been published, and is available for 15c. from the Department at Ottawa. It is merely a review of the government's activities for the year in the mining geological field.

Economic Geology—*Economic Geology* for January-February (Lancaster, Pa.; price 65c.) contains the following papers: "Silver Ores of South Lorrain and Cobalt, Ontario," 24 pages, by Edson S. Bastin; "The Magnesite Deposits of Manchuria," 29 pages, by Kunitaro Niinomy; "Paragenesis of Marcasite," 13 pages, by W. H. Newhouse; "Geology of the Oilfields in Japan," 16 pages, by G. Kobayashi; and "Balance Sheets for Mine and Smelter Production of Domestic Copper, Lead, and Zinc," 14 pages, by C. E. Sieben-thal.

Weights and Measures—The proceedings of the seventeenth annual conference on weights and measures has been published by the U. S. Bureau of Standards as Miscellaneous Publications No. 59, 147 pages, obtainable for 35c. from the Superintendent of Documents, Washington, D. C.

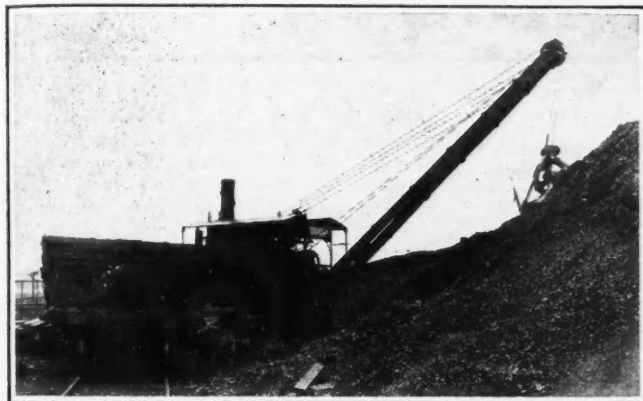
Zinc for Roofing—U. S. Bureau of Mines *Reports of Investigations* No. 2,652, 10 pages, obtainable on request from Washington, D. C., discusses the use of pure zinc for roofing, giving its advantages and describing the various accepted methods of laying it. The author is Charles E. van Barneveld.

Nevada Mining—The biennial report of the Nevada State Inspector of Mines for 1923-4, 64 pages, has recently been issued and is obtainable from A. J. Stinson, Carson City, Nev. The report is chiefly concerned with a review of mining accidents in the state.

Paint Specifications—U. S. Bureau of Standards Technologic Paper No. 274, 46 pages, is by P. H. Walker and E. F. Hickson, and is entitled "Use of United States Government Specification Paints and Paint Materials." This is an interesting guide to the proper kind of paint to use for various purposes, how to apply it, and how to mix various paint materials together.

Status of Engineers—Under the title, "Engineers and Chemists: Status and Employment in Industry," the International Labor Office, in co-operation with the International Committee on Intellectual Co-operation of the League of Nations, has made an 88-page report on the results of an investigation of the status of engineers and chemists in about twenty-five countries. Men engaged in technical work only are considered. In general, the situation in other countries is not greatly different from that in the United States. Little benefit to either the public or the engineer has resulted from attempts to certify or license engineers. Remunerations seem to be disproportionately low compared with that of manual workers, for the lower grades of engineers. Salaries have not as a rule gone up in proportion to the cost of living since 1914. Copies of the report may be obtained for 30c. from the World Peace Foundation, 40 Mount Vernon St., Boston, Mass.

New Machinery and Inventions



This 10-ton crawling tractor crane is readily convertible into a shovel or a pile driver. Any equipment that operates on a boom can be applied, the maker states.

Another Crawling Tractor Crane

A new 10-ton crawling tractor crane has been announced by the Industrial Works, Bay City, Mich. This crawler crane, known as Type DC, is similar in outward appearance to the former types of tractor cranes built by the company, but its design embodies various features such as split gears for propelling, increased speeds, double-clutch mechanism, unusually long tractor belts, and independent functions.

Each tractor belt is separately controlled by a system of split gears. Two concentric vertical propelling shafts at the axis of revolution lead two independent but concentric trains of spur and bevel gears, each operating one tractor belt. Each belt is directly controlled by two powerful friction clutches and brakes in the revolving upper-works, which gives absolutely independent, definite, and easy control over each belt while propelling. This is an all-gear drive from engine to sprockets, with no chains in the mechanism. Maneuvering in close quarters is comparatively simple.

All speeds of the motor-operated crane have been increased 25 per cent, which provides ample speed for the fastest possible handling of all materials. This new feature should assure a material saving in time and a corresponding saving in money.

A double-clutch mechanism by which the two slewing-band clutches are operated by one lever makes for simple slewing. The direction of slewing is changed at will by the movement of the slewing double-clutch lever. No reversal of the engine is necessary.

The crawling tractor belts are of ample length to give plenty of stability when lifting over either end, on any kind of ground. The center distance between the two end sprockets is 10 ft., giving ample stability and support for a large range of operation.

All functions are independent of one another, giving greater certainty of operation. Separate levers actuating each function are conveniently placed on the operator's platform in the revolving upper-works. Different combinations of these independent functions may be utilized at one time, to great advantage.

The crane can be equipped to operate with a steam engine, electric motor,

gasoline motor, or fuel-oil engine of the Diesel type. It operates with clamshell or dragline bucket, electro-magnet, hook and block, or grapple.

Gyratory Crusher Litigation Finally Settled

On the refusal of the United States Supreme Court to review the case of Worthington Pump and Machinery Corporation vs. Traylor Engineering and Manufacturing Co., the United States District Court for the eastern district of Pennsylvania has made effective its injunction restraining the Traylor company from manufacturing, selling or using gyratory crushers, covered by claims of U. S. Patent No. 960,231. The decision in the original suit for infringement was handed down by Judge Dickinson of the District Court sustaining the claims of the patent and holding that the Traylor Bull Dog crusher was an infringement of the Superior McCully crusher of the Worthington company. This decision was affirmed Oct. 1, 1924, by the United States Circuit Court of Appeals, which later denied a petition for rehearing. On refusal of the United States Supreme Court to review the case, the injunction of the District Court was made effective March 23, 1925. The Allis-Chalmers Manufacturing Co., of Milwaukee, is the only company now licensed by the Worthington company to manufacture gyratory crushers under this patent.

Two-speed synchronous motor for mine ventilation. It can be run at either speed without changing the frequency of the power supply. It can also be applied to hydro-electric generation of electricity.

A Two-speed Synchronous Motor for Mine Ventilation

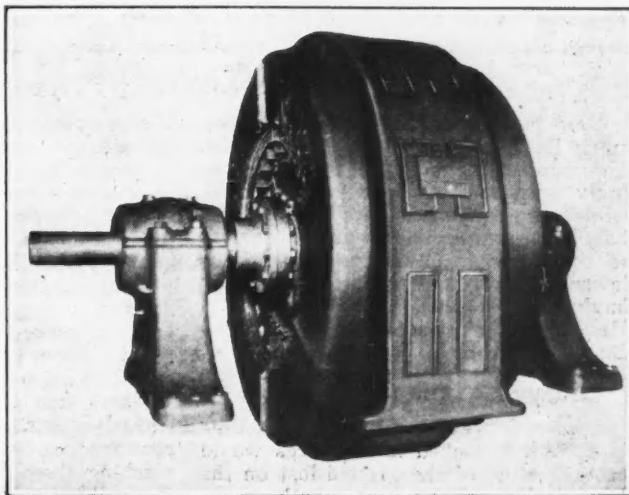
A salient pole synchronous motor which can be run at either of two speeds without changing the frequency of the power supply has been developed by the General Electric Co. One of these machines has already been built, rated 5,000/2,500 hp., 600/300 r.p.m., for operation at unity power factor. Possible applications of such a motor would be in mine ventilation, ship propulsion, and, when used as a generator, in hydro-electric generation of electricity.

The revolving poles of the two-speed motor are fitted with a special shoe of such form that each two adjacent poles can be excited with the same polarity. Thus the motor can be connected for either normal or one-half normal number of poles by throwing a pole-changing switch for the stator winding and a reversing switch for the field winding. Operated as a generator, this principle makes it possible to obtain two frequencies at the same speed or the same frequency at two different speeds.

In mine-fan installations, where the full capacity of the fan is not required at times, and where a speed ratio of two-to-one is satisfactory, the two-speed synchronous motor should find efficient application. By its use in ship propulsion half speed could be obtained at normal frequency, thus allowing the turbine to be operated at normal speed where the efficiency is maximum.

A Bulletin on Conveyor Weighing

The advantage of keeping an accurate check on weights of raw material is well recognized, and it is common practice today, at many important plants at least, to weigh the production of ores at some point between the shaft collar and the concentrating plant; or, if it be a cement mill or similar plant, to weigh the various materials used before mixing them. The subject is discussed in the new bulletin (No. 1224) just issued by the Merrick Scale Manufacturing Co., Passaic, N. J. In this are described the construction and applications of the Merrick conveyor weightometer, which, when installed on a conveyor, weighs all material passing over it and mechanically registers the weight. The bulletin is well illustrated.



The Market Report

Daily Prices of Metals

Apr.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
9	13.375	49.75	50.25	8.05@8.25	7.80	7.15
10	13.25@13.375	50.00	50.625	8.05@8.25	7.75	7.10@7.125
11	13.25@13.375	49.875	50.50	8.05@8.25	7.75	7.10
13	13.25@13.375	49.875	50.50	8.05@8.25	7.70@7.75	7.05@7.125
14	13.25	49.50	50.125	8.00@8.25	7.675@7.70	7.00@7.05
15	13.25	49.875	50.50	8.00@8.25	7.65	6.95@7.00
Av.	13.302	49.813	50.417	8.142	7.727	7.075

*The prices correspond to the following quotations for copper delivered: April 9th, 13.625c.; 10th to 13th, inc., 13.50@13.625c.; 14th and 15th, 13.50c.

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

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

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

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

London

Apr.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
9	61	62	65	232	234 $\frac{3}{4}$	33	32 $\frac{3}{4}$	35 $\frac{1}{4}$	33 $\frac{1}{4}$
10	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...
14	60 $\frac{1}{8}$	61 $\frac{1}{8}$	64 $\frac{1}{2}$	229 $\frac{1}{2}$	232 $\frac{1}{2}$	32 $\frac{1}{2}$	32 $\frac{1}{8}$	34 $\frac{7}{8}$	33 $\frac{1}{2}$
15	60 $\frac{3}{8}$	61 $\frac{3}{8}$	64	229 $\frac{3}{4}$	233 $\frac{1}{4}$	32 $\frac{3}{8}$	31 $\frac{3}{8}$	34 $\frac{3}{4}$	33 $\frac{3}{4}$

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

Silver, Gold, and Sterling Exchange

Apr.	Sterling Exchange "Checks"	Silver		Gold London	Apr.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
9	4.77 $\frac{5}{8}$	66 $\frac{1}{8}$	31 $\frac{1}{2}$	86s 5d	13	4.77 $\frac{3}{4}$	67 $\frac{1}{4}$	...	...
10	4.77 $\frac{5}{8}$	66 $\frac{3}{8}$	...	...	14	4.77 $\frac{5}{8}$	67 $\frac{1}{2}$	31 $\frac{1}{8}$	86s 5d
11	4.77 $\frac{1}{2}$	67	...	...	15	4.78 $\frac{1}{8}$	67 $\frac{1}{8}$	31 $\frac{9}{16}$	86s 7d

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

Metal Markets Listless; Prices Lower

New York, April 15, 1925—A holiday spirit has pervaded the metal markets. The copper market has been exceedingly dull, and so have zinc and tin, while the amount of activity in lead has been nothing noteworthy. Prices of these metals have again worked to lower levels, with consumers generally buying only because of strict necessity. Underlying conditions in the United States seem to be splendid.

Copper Available at 13.50c.

Copper is weaker. For a short time last week it looked as if prices would recover some of the ground lost on the long decline of the past month or so, but the better feeling was short lived.

Easier quotations were made in London, unsettling the market here and causing buyers to hold off. Sales for the week were only a few million pounds all told. Some of the copper brought 13 $\frac{5}{8}$ c. delivered; other lots were sold for 13.50c., at which price the metal can be easily procured today. The scene of greatest activity in copper during the week was Europe, where competition was unusually keen. Prices as low as 13.65c. c.i.f. were quoted, and the volume of business done was larger than in the United States. Manufacturers of copper products report that orders are reaching them regularly, but ordinarily in small tonnages, from very diversified industries. Production of copper is

showing a rising tendency, and probably has something to do with the easier market conditions. A few producers have been out of the market entirely for the week at these prices. The market has seen few periods as dull as the last seven days.

Lead Weakens Further

The contract price for New York lead, set by the American Smelting & Refining Co., continues at 8.25c.

Though the Smelting company has made no further reduction, the lead market has been perceptibly weaker in the last few days, probably owing almost entirely to continued declines in London. London prices have been discouraging in the face of the improved buying that has taken place in the last week or two. Lead is freely obtainable in New York City and surrounding points at 8c., from several sellers. In the Middle West, the price has declined even more, for whereas a week ago 7.80c. was an inside price, 7.65c. could be done today in at least two directions. However, not all sellers are meeting the present market. One prominent producer is well sold up even into May, and another is so sure that the reaction has about spent itself that he prefers to accumulate a little lead at present levels rather than to cut prices. Those who have been willing to sell at the lowest prices have done an excellent business, and it is evident that consumers have considerably less lead on hand than normally. They practically all want April shipment.

Smelters report that their intake of ores is almost as great as it was when lead was two cents higher; in certain sections there is perhaps less of a tendency to ship high-zinc ores and take the penalty, but it is evident that few miners have found it advisable to reduce their output because 8c. lead will not pay. Corroding grades are generally quoted at \$2 per ton premium over common lead.

No Strength to the Zinc Market

Prime Western grades of zinc have been in poor demand. The sales made were principally for May, June, and July shipment, with little interest shown in April zinc. Prices received ranged from 7.15c. last Thursday to below 7c. today. Brass Special has been in good demand by several interests that failed to cover lately, with the result that there is a "squeeze" of this product, with the full premium of \$2 per ton ruling.

Statistics of the American Zinc Institute for March show about the same rate of production as prevailed in February, allowing for the shorter period, and compare as follows in tons:

	Feb.	March
Stock, first of month.....	18,996	16,703
Produced, tons.....	46,811	51,485
Shipped, tons.....	49,104	50,992
Stock, end of month, tons.....	16,703	17,196
Shipped from plant for export, tons.....	6,467	5,337
Stored for customers, tons.....	90	.....
Retorts operating, end.....	87,377	86,529

Although buying from Europe is anxiously awaited in this market, the relation of the London and export markets is too far apart to permit this. Furthermore, a greater amount of zinc is being produced by Germany now than for many months. Germany has actually exported the metal recently. A pronounced backwardation or discount on future metal exists in the London zinc market. In the domestic market the discount is about 2½ points per month.

Tin Close to 50c.

Some tin sold as low as 50c. yesterday, though the average sales of spot Straits for the day were slightly above this level. This is the lowest price for tin since Oct. 17, and represents a decline of 10c. per lb. from the level early in January. Sales to consumers have been fairly good; in fact, very satisfactory, considering the long holiday in the London market. Forward tin has sold at approximately the same prices as spot.

Silver Unsteady

On April 9, the last business day abroad prior to the Easter holidays, London was bidding below current rates for prompt silver shipment from New York, evidently in anticipation of a decline in price. Good Friday was quiet, but the local market appeared steady. April 11 and 13 were holidays in London, with the result that India orders came to New York, and on the latter day business was very active, there being a strong demand for spot silver for immediate shipment on the strength of a reported "squeeze" for the May settlement in Bombay. This demand continued on April 14, and the London market opening again after the holidays was quoted ¼d. higher than the closing rate of last week. The following day, however, ¼d. of the London advance was lost on account of pressure from speculative sales, and New York declined in sympathy.

Mexican Dollars: April 9th and 10th, 51½c; 11th, 51¾c; 13th, 51¾c; 14th, 52c; 15th, 51¾c.

Foreign Moneys Unchanged

Practically no changes have occurred since last week in the principal foreign exchanges. Closing cable quotations on Tuesday, April 14, were: francs, 5.1375c.; lire, 4.09875c.; and marks, 23.81c. Canadian dollars, ¼ per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

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

Antimony—

Chinese brands, 12.50@13.50c. per lb. Cookson's "C" grade, 16¾c.

Chinese needle, lump, nominal, 10c.

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

White oxide, Chinese, 99 per cent Sb₂O₃, 16c. nominal.

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

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

Iridium—\$375@400 per oz. London £70.

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

Palladium—\$79@83 per oz. London £17.

Platinum—\$118.50 per oz. refined. London, £25 per oz.

Crude, \$115.

Quicksilver—\$83 per 75-lb. flask. San Francisco wires \$82.35. Quiet. London £13½.

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

Metallic Ores

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

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

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

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

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

Tungsten Ore—Per unit, N. Y.:

Chinese wolframite, \$11.

High-grade Western scheelite, \$11 nominal.

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

Zinc Blende Unchanged—Lead Ore Lower

Joplin, Mo., April 11, 1925

Zinc Blende	Per Ton
High	\$54.95
Premium, basis 60 per cent zinc	\$51.50@53.00
Prime Western, 60 per cent zinc	\$50.00
Fines and slimes	\$48.00@\$46.00
Average settling price, all	\$50.92

Lead Ore

High	\$121.80
Basis, 80 per cent lead	\$95.00
Average settling price, all	\$107.62

Shipments for the week: Blende, 15,027; calamine, 38; lead, 3,000 tons. Value, all ores the week, \$1,102,120.

With the continued decrease in the demand for ore, a number of producers have initiated a policy of restricting their output, and more than a dozen mills are closed down for a general overhauling. Others, who were pushing production with night shifts, have ceased the night work, and one mine company has adopted a five-day week. Production was restricted notably this week, but a continuation of this policy will bring drastic results in another week.

Lead continues to recede in price, but there is no decline in the demand. Settlement prices continue on an average level about two weeks behind the basis price offerings.

Platteville, Wis., April 11, 1925

Zinc Blende Per Ton
Blende, basis 60 per cent zinc.....\$50.00

Lead Ore

Lead, basis 80 per cent lead.....\$110.00

Shipments for the week: Blende, 750 tons; lead, 40 tons. Shipments for the year: Blende, 10,146; lead, 607 tons. Shipments for the week to separating plants, 1,801 tons blende.

Non-Metallic Minerals

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

Mineral Products

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

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

Ferro-Alloys

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

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

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

Metal Products

Zinc Sheets—10c. per lb.

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

Refractories

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

Steel Firm—Pig Iron Dull

Pittsburgh, April 14, 1925

Steel ingot production for March furnished a surprise, as it was 3.2 per cent higher than in February. Though current buying is only about 60 per cent of capacity, this indicates heavy consumptive requirements. It is probable that this year will stand high in steel production and consumption. There are no quotable declines in finished steel prices.

Pig Iron—The market remains stagnant. Bessemer and foundry are off 50c., being now quotable at \$21.50 for bessemer and \$20.50 for basic and foundry, Valley.

Connellsville Coke.—Market extremely dull, with spot furnace easier at \$3.15@\$3.25 and spot foundry unchanged at \$4@\$4.50.

March
6,703
1,485
0,992
7,196
5,337
6,529

Company Reports

Consolidated Mining & Smelting Co. of Canada, Ltd.

The Consolidated Mining & Smelting Co. of Canada, Ltd., in its report for 1924 states that after taking care of current development, depreciation, and depletion, and paying interest on bank loans, the net profits were \$4,341,014.30, compared with \$2,401,346.71 in 1923, \$1,467,528.11 in 1922, and \$570,043.77 in 1921.

After providing for bond interest, the remainder, \$4,069,023.26, was transferred to profit-and-loss account.

The large sum \$790,120.42 was necessarily reserved for federal and provincial taxes under the existing exorbitant basis of taxation.

Developments and operations at the Sullivan mine were satisfactory. Operations at Rosslund were not satisfactory. Conditions in the other properties of the company are practically unchanged.

The capacity of the zinc plant is being doubled and the daily capacity of the lead refinery is being increased to 325 tons. Other substantial additions are being made to the smelter.

Balance Sheet Dec. 31, 1924

Liabilities		
Capital		
Authorized: 600,000 shares at \$25 each.....	\$15,000,000 00	\$10,695,850 00
Bonds.....		3,866,500 00
Special loan.....		1,000,000 00
Advances from West Kootenay Power & Light Co.....		504,351 01
Bond interest accrued.....		136,409 07
Reserve for taxes.....		624,845 70
Dividends payable Jan. 15, 1925.....		320,875 50
Advances on metals and zinc concentrates in transit.....		2,328,699 42
Fire insurance reserve.....		74,151 22
Accounts payable.....		954,327 23
Profit-and-loss account		
Balance Dec. 31, 1923.....	\$3,104,325 73	
Profit for year ended Dec. 31, 1924.....	4,069,023 26	
	\$7,173,348 99	
Less income and taxes paid and reserved for in 1924.....	790,120 42	
	\$6,383,228 57	
Less two dividends.....	641,043 00	5,742,185 57
		\$26,248,194 72
Assets		
Mines, mineral claims and shares in other companies.....	\$10,309,017 78	
Less provision for depletion.....	518,055 41	
		\$9,790,962 37
Mining, smelting, concentrating and refining plants.....	\$10,041,476 47	
Less depreciation.....	1,051,413 75	
		8,990,062 72
Ores, metals and smelter products on hand and in transit.....		4,700,468 06
Mines and smelter stores and material.....		1,755,499 43
Accounts receivable.....		677,095 34
Insurance paid in advance.....		28,774 09
Dominion of Canada Victory Bonds.....		77,045 72
Cash in bank and on hand.....		228,286 99
		\$26,248,194 72

Production was as follows in 1924: 1,133,523 tons of ore; 26,976 oz. of gold; 4,074,044 oz. of silver; 161,400,769 lb. of lead; 1,382,750 lb. of copper, and 192,197,824 lb. of zinc.

Hedley Gold Mining Co., Ltd.

Gold, British Columbia

During 1924, 48,300 tons of \$9.06 ore was mined and milled by the Hedley Gold Mining Co., operating in British Columbia, and sufficient new ore was developed to show a reserve tonnage of 48,000 tons of \$9.18 per ton.

Balance Sheet, Dec. 31, 1924

Assets		
Fixed.....		\$2,221,747 63
Deferred.....		70,679 68
Current.....		126,405 53
		\$2,418,832 84
Liabilities		
Capital stock		
Authorized and issued (240,000 shares, par value \$10 each).....	\$2,400,000 00	
Current.....	20,110 61	
Reserves.....	5,045 33	
Surplus		
Deficit as at Dec. 31, 1923.....	\$41,175 51	
Net earnings for 1924.....	34,852 41	
		6,323 10
Deficit as at Dec. 31, 1924.....		\$2,418,832 84

Wright-Hargreaves Mines, Ltd.

Gold; Kirkland Lake, Ont.

Balance Sheet as of Dec. 31, 1924

Assets		
Current assets.....		\$710,753 93
Capital assets.....		1,880,184 96
		\$2,590,938 89
Liabilities		
Current liabilities.....		\$213,306 49
Capital stock		
Authorized and issued.....	\$2,750,000 00	
Less, shares discount.....	545,003 20	2,204,996 80
Surplus		
Balance from 1923 statement.....	\$55,039 36	
Net from operation—1924.....	580,514 71	
Overprovision 1923 taxes.....	1,497 72	
		\$637,050 79
Deduct		
Dividends paid 1924.....	\$206,250 00	
Dividend payable Jan. 1, 1925.....	137,500 00	
1924 Taxes—payable 1925.....	44,626 89	
Preliminary development cost (charged off 1924).....	76,038 30	\$464,415 19
Balance free surplus.....		172,635 60
		\$2,590,938 89

Profit-and-Loss Statement

Bullion production.....	\$1,088,725 53
Operation costs.....	535,049 76
From operation.....	\$553,675 77
Other income.....	26,838 94
Net surplus.....	\$580,514 71

During the year 84,487 tons of ore were treated by Wright-Hargreaves, Ltd., and the bullion received therefrom amounted to \$1,088,725.53, with an average value per ton of \$12.89. The broken ore on hand Dec. 31, 1924, amounted to 118,331 tons, an increase to reserve over a year ago of 41,630 tons. The mill operated 93.10 per cent of its possible running time, and treated on an average of 230 tons per day, an increase of thirteen tons per day over the year 1923.

Analysis of Operating Costs

	Totals	Cost Per Ton Milled
Development and exploration.....	\$82,345 06	\$0 975
Stopping.....	144,525 06	1 711
Transporting ore (hoisting, etc.).....	47,704 42	.565
Milling charges.....	121,342 45	1 436
Marketing bullion.....	8,487 51	.100
General and undistributed charges.....	62,125 46	.735
Depreciation plant and equipment.....	68,519 80	.811
	\$535,049 76	\$6 333

Arizona Commercial Mining Co.

Copper; Globe, Ariz.

During 1924 the Arizona Commercial Mining Co. had a net income before depletion of \$290,413.64.

The total production for the year was as follows: Refined copper, 7,760,931 lb.; silver, 32,634 oz.; gold, 1,883 oz.; 8,446,909 lb. of refined copper was sold to buyers at an average price of 13.188c. per pound.

Balance Sheet, Dec. 31, 1924

Assets		
Fixed—Mining properties, plant and equipment.....		\$4,093,658 28
Current.....		627,463 64
		\$4,721,121 92
Liabilities		
Capital stock.....		\$1,325,000 00
Current.....		70,954 81
Reserves for depletion and depreciation.....		1,639,382 25
Surplus		
Balance Dec. 31, 1923.....	\$1,867,729 54	
Income for 1924.....	290,413 64	
Deduct depletion for 1924.....	\$2,158,143 18	207,358 32
Dividends.....	\$1,950,784 86	265,000 00
		1,685,784 86
		\$4,721,121 92

McKinley-Darragh-Savage Mines

Silver; Cobalt, Ont.

The 1924 report of McKinley-Darragh-Savage Mines shows a surplus of \$2,252.83 for the year.

Balance Sheet, Dec. 31, 1924

Assets		
Current assets		\$271,301.92
Capital assets:		
Mining properties	\$2,106,244.88	
Mine buildings, plant and equipment, less depreciation	6,433.24	
		\$2,112,678.12
		\$2,383,980.04
Liabilities		
Current liabilities		
Accounts payable and accrued wages, and other charges		\$16,290.87
Capital stock		
Authorized	\$2,500,000.00	
Issued		2,247,692.00
Surplus, Dec. 31, 1923	\$117,744.34	
Surplus from revenue and expenditure account 1924	2,252.83	
		\$119,997.17
		\$2,383,980.04

General Statement of Operations

	Ounces
Silver on hand Jan. 1, 1924	83,697
Silver recovered during 1924	365,679
Silver shipped during 1924	394,019
Silver on hand, Jan. 1, 1925	55,357
Average price received per ounce, cents	67.116
Average cost per ounce, cents	64.103

The average grade of ore hoisted was 7.25 oz. per ton, compared with 9.57 oz. per ton in 1923, a decrease of 2 1/2 oz.

Tonnage hoisted of 56,148 is an increase of 21,379 tons over that in 1923.

Total costs show a decline from \$5.421 per ton in 1923 to \$4.20 per ton in 1924.

Coniagas Mines, Ltd.

Silver; Ontario

The report of the Coniagas Mines, Ltd., for 1924 states that a serious fire which occurred on May 30, 1924, destroyed the greater part of the surface plant and equipment of the mine, and the milling equipment. From Jan. 1, to the date of the fire, production was maintained at practically the same rate as throughout the previous year. Silver paid for by the smelters during the five months' period amounted to 555,772 oz., resulting from the milling of 62,164 tons of mine ore and 17.1 tons of high-grade ore.

The average cost of silver produced during the last eighteen years, including all charges, has been 20.4c. per ounce.

There remains in the Coniagas and Trethewey mines at this time about 30,000 tons of broken ore, containing approximately 200,000 oz. of silver, but the directors are of the opinion that it would not be a profitable undertaking to erect a new milling plant to handle this material at present.

During the last year dividend No. 58, of \$100,000, being 2 1/2 per cent on the company's capital stock, was paid.

Balance Sheet, Dec. 31, 1924

Assets		
Capital assets		\$500,000.00
Real estate, camps and buildings and equipment	28,131.34	
Capital investments	1,653,343.98	
		\$2,181,475.32
Other investments		\$1,506,446.91
Current assets		
Cash on hand and in banks	\$130,202.08	
Accounts receivable	72,573.41	
Inventories	4,993.12	
		207,768.61
Deferred charges to operations		280.06
		\$3,895,970.90
Liabilities		
Capital—800,000 shares of \$5 each, fully paid	\$4,000,000.00	
Less amortization	3,584,848.63	
		\$415,151.37
Surplus		
Loss and gain account	2,268,441.95	
		\$2,683,593.78
Current liabilities		114,042.32
Coniagas Mines, Limited, for balance on subscription	800,000.00	
Reserve for contingencies	270,211.46	
Reserve for depreciation	28,123.34	
		\$3,895,970.90

Dolores Esperanza Corporation

During 1924 the Dolores Esperanza Corporation milled 59,530 tons. Operating and development expenses amounted to \$13.07 per ton. This figure included \$77,232.08 taxes paid to the Mexican Government on the gross value of bullion exported. The corporation shipped to the refinery 14,026.12 oz. of gold and 797,688 oz. of silver. Extraction was estimated at 92 per cent of the contents of the ore.

Substantial ore reserves have been proven in the Gloria mine, and in consequence steps have been taken for the construction of a power plant and a flotation mill, capable of handling fifty tons of ore per day. Work is now progressing satisfactorily on the mill, and the machinery is arriving rapidly at the mine. It is expected that this plant will take about six months to complete.

Consolidated Profit-and-Loss Account

Revenue	\$855,414.60
Expenditures	762,039.93
Profit for 1924, before charging depletion and depreciation	\$93,374.67

Consolidated Surplus Account

Surplus, Dec. 31, 1923	\$2,830.60
Add profit for 1924	93,374.67
	\$96,205.27

Assets		
Contra		
Development work on property	\$100,572.56	
Reserve for depreciation	\$52,768.74	
Reserve for doubtful accounts	5,733.16	58,501.90
		159,074.46
Consolidated deficit as at Dec. 31, 1924, as per balance sheet		\$62,869.19

Consolidated Balance Sheet, Dec. 31, 1924

Assets		
Current assets		\$369,665.08
Concentrates at La Dura—estimated value		70,005.00
Deferred charges to future operations		146,554.83
Claims against Mexican Government		132,855.28
Advances to subsidiary co.—Consuelo Milling, Mining & Power Co.		5,491.20
Property account—mines, mining claims, plant and equipment— at book values		1,075,152.65
		\$1,802,724.04
Liabilities		
Current liabilities		\$57,867.07
Minority holders' interest in capital stock of subsidiary companies (at par)		22,366.00
Capital stock		
Authorized—1,000,000 shares of \$2 each	\$2,000,000.00	
Issued and outstanding, including \$75.20 scrip	\$1,728,175.20	
Less deficit, Dec. 31, 1924	62,869.19	
		1,665,306.01
Stockholders' book equity		57,184.96
Reserves, employers' liability, depreciation		
		\$1,802,724.04

Mohawk Mining Co.

Copper; Michigan

A summary of results of the Mohawk Mining Co. for 1924 follows:

Rock hoisted, tons	734,060	
Rock stamped, tons	702,534	
Product of refined copper, lb.	15,215,197	
Yield of rock treated per ton, lb.	21.657	
Cost per ton of rock hoisted	\$1.898	
Total operating cost per pound of refined copper		9.158
Cost of taxes (exclusive of income and profits taxes)		0.403
Cost of smelting, freight and marketing product		1.848
		11.409

Profit for the year before depletion and depreciation amounted to \$241,854.

Balance Sheet, Dec. 31, 1924

Assets		
Current assets		\$1,495,496.29
Investment in securities		204,340.10
Capital assets		16,585,665.71
		\$18,285,502.10
Liabilities		
Current liabilities		\$141,716.60
Depletion	\$7,328,586.09	
Depreciation	2,578,747.43	
		9,907,333.52
Unrealized appreciation of ore bodies, at Dec. 31, 1924		4,099,773.57
Capital stock		2,070,000.00
Surplus		2,066,678.41
		\$18,285,502.10

Income and Profit-and-Loss Account

Sales—17,908,506 lb. copper at 13.5147c.	\$2,420,275.35
Net cost of copper sold	2,113,192.56
	\$307,082.79
Profit on sales of copper	
Miscellaneous income	34,771.77
Profit for the year before providing for depreciation and depletion	\$341,854.56

Mining Stocks

Week Ended April 11, 1925

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

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