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A Miners' Camp in the Bush, North Queensland

The Santa Barbara 500-Ton Mill

By Fred M. Heidelberg

The Permian Revolution in North America

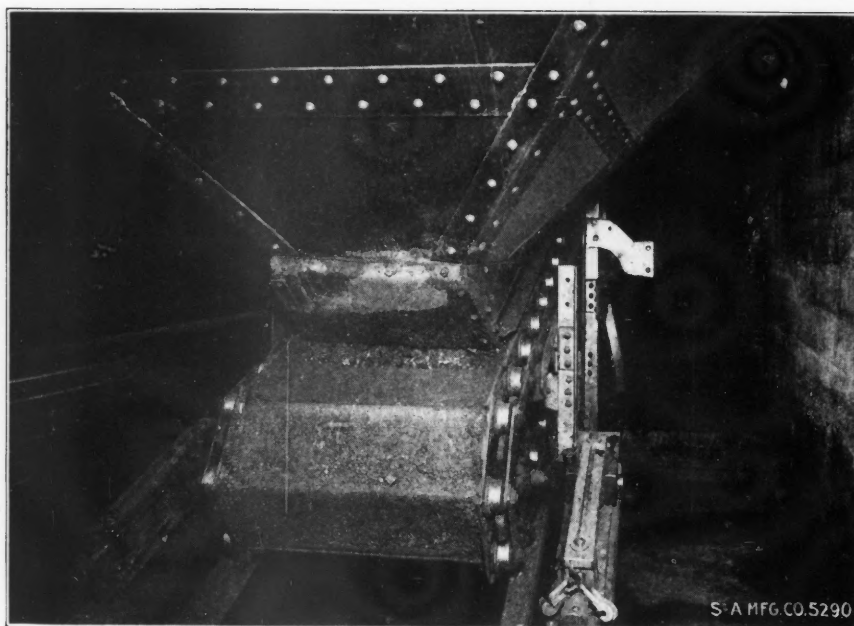
By James R. Finlay

Recent Developments in Mining in Jalisco and Nayarit, Mexico

By Henry M. Payne

Biography of Hugh F. Marriott

The Hollinger gold mine, unknown thirteen years ago, now rivals the New Modderfontein, with which it is compared in this issue, as the world's premier gold producer. Monthly dividends of a quarter of a million dollars are being paid to stockholders.



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The Anaconda-American Brass Merger

AFTER MANY RUMORS, denials, further rumors, and more denials, it appears to be a foregone conclusion that the Anaconda Copper Mining Co. will acquire the American Brass Co. This will mark an exceptionally important development in the copper industry. For many years Anaconda has been active in the manufacture of rods and wire at its Great Falls plant, the success of which has evidently induced the company to expand its manufacturing interests in a slightly different channel.

It is to be noted that this gigantic corporation includes multitudinous ramifications. Copper, lead, zinc, gold, silver, rare metals, coal, phosphate, brick, sulphuric acid, and lumber are some of the most important commodities it produces, not to mention the smelting, refining, transportation, and, in part, the manufacture into finished form of some of its products. In its growth Anaconda has branched more and more into the conversion of its metals to articles fit for the ultimate consuming markets. Only last year an electrolytic white-lead plant established in East Chicago was placed in operation, but the acquisition of the American Brass Co. will eclipse anything heretofore done by Anaconda in the expansion of its manufacturing enterprises.

Although Anaconda is capitalized at \$116,562,500, and American Brass at \$15,000,000, the actual comparative value of the two is at present more nearly expressed by the ratio 2.5:1. Anaconda is absorbing a company almost half as large, from a financial standpoint, as itself.

The copper industry has been slow to follow the lead of other industries in supervising the utilization of its raw materials and their transformation into finished marketable form. The development is an old one in others, and is well illustrated by the organization of the Standard Oil Co., the United States Steel Corporation, and the Aluminum Company of America. All of these corporations may be considered to fall into the so-called "vertical trust" type of combination, which is the term used to designate an organization that controls the handling of a commodity from its original production as a raw material to its final disposal as a completed product to consumers. This is to distinguish it from the "horizontal trust," which controls some particular part of the path from producer to consumer. The American Brass Co. may be grouped in the latter class, as it is a consolidation of many subsidiary companies engaged in the same manufacturing activity. The development of trusts has reached its highest point in Europe.

Both Anaconda and American Brass have had long and eminently successful careers. By their merger the largest producer of copper joins hands with the largest consumer. The copper consumption of American Brass is so large—estimated to be between twenty and thirty million pounds monthly—that Anaconda will be unable

to fill both the brass company's and its own wire mill's requirements from the twenty million pounds or so that Anaconda normally produces each month. American Brass will have to make outside purchases of copper.

The consolidation will partly replace the copper business that other producers have had with this good customer, but will, at the same time, give a better market to other copper producers in the remaining consuming fields. It should have no effect on the business of copper marketing other than to eliminate Anaconda from active participation therein. Anaconda will henceforth be interested more in the outlet for brass and wire than in the market for copper, which, in view of the criticism leveled at manufacturers and retailers of copper and brass products, will be a splendid development, as it should insure the injection of the producer's viewpoint into the manufacture and sale of the finished products. Anaconda will obtain an excellent opportunity to popularize copper and brass.

What Can Be Done To Revive The Mining Industry?

THE NEW YORK SECTION of the American Institute of Mining and Metallurgical Engineers recently held a meeting at which competent "diagnosticians and physicians" were summoned to determine "what can be done to revive the mining industry." This lean and debilitated old stager was trundled in under the sympathetic eyes of his well-wishers. The learned "doctors" determined that "world conditions" had infected the patient directly in the copper part of his anatomy and indirectly in all his other metallic and non-metallic parts. C. F. Kelley, the copper specialist summoned to the consultation, after indicating the foregoing diagnosis, called attention to the importance of improving the merchandising of copper and copper products. In our opinion, in this he has struck a hot trail and one that will lead to substantial and permanent good not only in the copper but also in other mining lines.

Hitherto, the mining industry, and particularly the copper-mining industry, has conducted its business like old John Taylor did his. John Taylor was an old-time merchant. He wore a frock coat and bore with dignity, when going to and from his place of business, a high hat of unimpeachable polish. His gray sideburns and active eyes impressed a pleasing personality upon his customers. He often sold his own goods. His reputation for honest dealing was long, broad and deep. But John Taylor never went after business in the modern way. What came to him naturally sufficed, and a more energetic merchant bought him out and established an important and far-reaching business upon the honest seed planted by John Taylor. Modern merchandising was responsible.

It seems to us that the mining industry has passed the John Taylor stage of its existence and must study

the principles of present-day merchandising. It must actively protect the demand factor and seek by every legitimate means to increase demand. It has placed its goods upon the commercial counter and has complacently awaited customers, and has then given but little concern as to what happens to its goods en route to the final consumers. This attitude belongs to the antediluvian stage of merchandising.

Successful merchants go after business and protect that business at every turn. The mining industry will have to play the game in a similar way. The zinc people have got under way. The copper people are beginning to develop the industrial uses of copper. Other mining lines must find or create similar opportunities.

Competition Among the Metals

IN THE December issue of *The Nation's Business* is a prominent advertisement of a steel manufacturer in which two illustrations are displayed of metal housings such as one finds covering gears. One of these illustrations shows a pressed-steel housing, and the other is ostensibly made of aluminum. Above these photographs is the caption "Press It From Steel Instead," and below "Pressed Steel Saves 33½ Per Cent," followed by the claim that a saving of 33½ per cent in cost was made by the substitution of pressed steel for the use of aluminum in this particular application of the metal.

This is an interesting sidelight on the keen competition that is going on among the metals, for which violently fluctuating markets and the destruction of normal price relations between them is responsible. Were the two photographs respectively of a copper and iron tack, or of some other article in whose manufacture both metals find independent employment, the lesson from the "ad" would be driven home more forcibly. As it is, the domestic aluminum industry is so closely controlled and so little is known of its operations that no great anxiety will be manifested over the particular example we have cited.

Copper producers are seriously concerned when someone mentions substitution, and they are devoting much time and thought as to how they can regain lost markets for their product. We have not seen any advertisements of the fact that in such and such an electrical transmission line copper displaced aluminum or vice versa, or—to step into another field—that zinc paint in a particular application is better than lead, or that steel can be used more profitably in a certain installation in preference to brass or bronze. Competition hasn't reached that stage where the metals are out to cut each others' throats.

Undoubtedly, it is within the right of every producer to indicate possible savings in the use of the metal which he produces, be it iron, copper, tin or some other one. We may look for such developments in the readjustment which is now taking place and in which each metal is seeking to recover an older superiority. Merit will be the ultimate basis upon which the use of each will depend. Careful weighing of price and physical characteristics will be required to determine the fitness of copper, aluminum, iron, or other metal for each especial use.

All the metals have fields which they occupy to the exclusion of others. Thus, copper is par excellence the metal for armature windings, iron for stoves, and aluminum when lightness is essential, as in airplane construction. Then there is a twilight zone in which com-

petition will naturally be keen. A good illustration is the electrical transmission field, in which both copper and aluminum are used. With copper selling for 13.75c. and aluminum for 17c. the lighter metal has a decided advantage, as whenever the price of aluminum is less than twice as much as that of copper it is more economical from a conductivity standpoint to use aluminum.

An advertisement similar to the one noted above is an excellent reminder of the race between the metals for enlarged markets. May the best one win!

Oh, Those Germans!

CONSIDERING THE INSISTENT REPORTS concerning the fabrication or transmutation of gold from base metals, it is really remarkable that this secondary or manufactured form of the element does not come upon the market. Some time ago we told editorially of the announcement by Engineering Foundation of the advent of an alchemist who looked to them as if he might be able to do the job. The latest herald or harbinger of free gold is none other than Prof. Irving Fisher, of Yale, distinguished economist and advocate of a market-basket purchasing-power dollar rather than a dollar on a gold security. In a speech at the London School of Economics on Dec. 16 and in an article published in the *New York Tribune* on Dec. 18, he said:

"We can imagine that the same German chemists who worked out the hideous chemical warfare will work out a chemical way of paying their debt. This seems now as chimerical as, before, the prognostications of Zeppelins bombing London. I have just been credibly informed that a German chemist has already succeeded in a laboratory in making synthetic gold out of baser metals by means of an electric vacuum furnace. It only remains to cheapen the process sufficiently, to flood the world with chemically manufactured gold and to make it worthless. In that case the reparation payment would become a farce and Germany instead of paying the penalty would get enormously rich by exploiting this new philosopher's stone."

We all have our little fears. Professor Fisher fears that Germany will make cheap gold and dump it on our shores. What we fear is that Professor Fisher's pet hobby of discarding gold for his own (to our notion) impracticable basis of currency, has influenced and inflamed his imagination as to the manufacture of gold. We not only fear it: we know it. What a lot of foolish, credulous, misleading, cheap talk is spread abroad by those who ought to know better!

A German Divining Rod

SPEAKING OF DIVINING RODS and ore-finding machines, of which the air, so to speak, is full (so that we expect some fine morning to wake up, and learn that all the ore has jumped out of the ground and lies still writhing in the bleak winter sunshine), we listened to a tale the other night, told by a successful and prominent business man, who held a very responsible position in Washington during the war, adjusting metal supply problems. His tale apparently related to the ore-finding instrument whose wonderful possibilities have been so strongly hinted at by Mr. Herman Holz, of New York, as commented on (unfavorably) in an editorial in our issue of Dec. 25, 1920.

The instrument to which our friend referred had recently been tried out by a former associate of his, a man experienced in the metal business. The instrument, on trial, had been found to be so delicate that, set up over an orebody in the iron country, it would register the amount of manganese in the ore; it would record the

passage of a car loaded with ore in a tunnel beneath, or the startings and stoppings of an ore-laden cage in a shaft. So active was the instrument that on one occasion when it was being carried in an automobile past a field to which it discovered attraction, on account of the land being (presumably) oil-bearing, it jumped from the seat through the windshield of the car, and landed thirty feet inside the field. Not only could it detect the oil in the ground, but the kind of oil—whether it had a paraffine base or what not. The instrument, it appeared, consisted in part of a device that revolved rapidly. The curious thing about it was that it revolved in one direction when in the hands of men, and in another direction when in the hands of women; and the very young or very old could not use it at all. By means of this instrument, it was related, thousands of acres of oil land had been located, and would be drilled.

Query: Why drill? Make a powerful, big, sixteen-cylinder, dreadnought size of this instrument, and the oil can be drawn out of the ground and into the tanks. A moderate sized make should be sufficient to draw metallic coin from the pockets of passers-by; it could be worn unostentatiously on the person, and could be scraped off after each promenade down Fifth Avenue.

This is also a German invention. Oh, those Germans! First, they make an instrument to locate all the gold in the earth and its assay value, and in the same breath they make a gold out of old iron and we shall have to put a tariff on it.

Wonderful! Colossal! And a never-ending line of suckers slip down the stream.

The Hartford Instrument

IF THERE IS ANY ONE who can beat the Dutch, however, it is the Connecticut Yankee, the legendary inventor of wooden nutmegs and oak hams. There is a man in Hartford—a responsible man—who sends us a story of what he has found, seen, tested with his own eyes. We publish extracts:

"DIVINING ROD" THAT MIGHT MAKE A POOR MAN RICH

"Why steal, hold up people and sell fake stocks and borrow money of friends with no intention of ever returning it?"

"A Hartford, Connecticut, man has a 'divining rod' that is a perfect magnet for gold, silver, and platinum."

No, the above is not intended to be humorous; it is the Hartford man's idea of writing an ad. He continues:

"It will not work on base metals at all, and it is the most peculiar thing the author ever ran across."

The promoter is a man of practical ideas:

"If this rod will find gold in places nearer civilization than many of the present gold fields it would be a godsend, as the precious metal could be handled much better and more money made in mining it."

True, O Connecticut Yankee: if you can locate gold mines at Hartford or in the Bronx, it would be convenient; or in the basement of the Treasury in Washington; but you have never heard of that other Connecticut Yankee's (Fisher, of Yale) prognostications that the Germans would dump cheap gold in New York and Washington. The ocean freights would be overcome by the cheap German labor and the depreciation of the mark, and we estimate that German gold could be laid down in New York at the wharf two dollars a ton cheaper than it could be produced, even if you were to locate your plant at Bethlehem, Pa. So your hopeful suggestion that the rod "might make a poor man rich" should be amplified thus: "and then, again, it might not."

The Mining and Metallurgical Society of America gives a gold medal each year for some great mining, metallurgical, or geological advance. What better use than to offer it for a competitive showing of all these methods of getting cheap gold?

We are let in on the mystery of the instrument more than we usually are—more than in the case of the instrument the marvelous workings of which Mr. Holz has hinted at. Concerning the Connecticut instrument:

"The rod is a small copper tube about three inches long and a half inch in diameter. It is closed at both ends, and the owner laughingly says when asked what is in it: 'If I told you, you would know as much about it as I do.' Attached to the rod are small bamboo or cane sticks. The sticks are soaked in water for a long time before being used, and they bend very easily when gold, silver, or platinum is waved in front of the tube. The operator, it has been proven, must be of a nervous high-strung temperament, and the tube will not work with only a certain percentage of the people. Just what percentage it is is a question unanswerable. The rod will not work when the base metals are placed before it. It will not answer to either copper or steel."

We discern some resemblance to the German rod we describe above—some hint at a uniform principle, not only of this rod but all other rods concerning which we have heard—in that the instrument's activities depend on the operator, who must be "of a nervous, high-strung temperament." But it does not draw the line at the infirm and aged as does the machine before mentioned.

"The rod came into the possession of the Connecticut man through making the acquaintance of an old farmer who lived high on a mountain top. This elderly farmer claimed that for nearly fifty years he had experimented with it. It worked perfectly with his wife, a woman of seventy years."

Nevertheless, the rod appears sensitive especially to women, and prefers blondes:

"The man who has this rod is a well-known Hartford, Connecticut, citizen. He does not exhibit the rod to the general public, only to his friends. He has studied it and has tried out all kinds of people, and declares that he believes women, particularly blondes, are more sensitive to its magnetism than brunettes."

What kind of magnetism is this to which blondes are more sensitive than brunettes? We ask this, because we have always believed that brunettes also were sensitive to gold, silver and platinum. Concerning this, the writer observes:

"If it is personal magnetism, it is something that should interest Science. It appears to be a magnetism and a strange one at that."

So far it has not been tested out in the mining districts, but only in town:

"Let a sensitive operator simply carry the rod and the bamboo or cane sticks on his arm through a city street, the rod will pull so that any person accompanying the operator can feel it. The pull only shows just when the operator is passing a bank or a jewelry store."

Why indeed, steal, hold up people, and sell fake stocks, when jewelry stores are everywhere?

One disadvantage the Connecticut instrument has as compared with the German instrument. The latter reacts to iron and manganese; the former will not work on base metals—as above, neither copper nor steel. Therefore, the Connecticut man should perfect his instrument before it is placed on the market, for since gold, as the Yale professor states, will be made from base metals, the problem is not to find gold, but the raw materials.

How fast they swim! Next!

The "Journal" To Publish Annual Progress Number

STOCK TAKING, inventories and from time-to-time appraisals are good things in an individual business—successful men consider them vital; the unsuccessful can sometimes trace their failure to this absence of a quantitative show-down. If this show-down is good for an individual business, how much more vital is it for an industry? That is just what we, in our annual numbers, do for the mining industries. Admittedly such appraisals are more or less incomplete, but the composite of them all is a barometer of the annual status of mining.

The annual this year will comprise five parts—Industrial Analysis (Standpoint of Mining), Industrial Efficiency, Current Problems, Editorial, and Market Comment. There will be a strong looking-forward element, constructive suggestion as to improvement in methods that will result in increased efficiency and greater economies. Men who are leaders in their respective lines will give you their best thought. As a mining engineer, you cannot afford not to give this Annual Number extended consideration and careful thought. If you are a superintendent, operator, or foreman, you will get a better perspective of your industry than in any other way. If you are a business man or manufacturer you will find the Annual an authoritative appraisal and a mine of information and excellent suggestion.

In the Industrial-Analysis section, H. A. C. Jenison will cover "Copper Mining"; Clinton H. Crane, "Lead Mining"; Arthur Thacher, "Zinc Mining"; Sidney J. Jennings, "Gold Mining"; F. E. Wormser, "Silver Mining"; D. E. A. Charlton, "Iron Mining"; John D. Northrup, "Petroleum."

In the Industrial-Efficiency section, Arthur Notman will present "Training Miners for Efficiency"; Benjamin F. Tillson, "Efficiency in Drilling and Blasting"; Charles A. Mitke, "Standards in Mining"; J. R. Finlay, "Reduction in Costs"; Guy H. Ruggles, "Trend in Milling Practice"; A. G. McGregor, "Trend in Smelting Practice"; Chester K. Gilbert, "Utilization of By-products in Mining."

In the Current-Problem section, H. B. Fernald will present "The Burden of Mine Taxation"; F. R. Raiff, "Mining Prosperity and the Railroad Problem"; Allen H. Rogers, "How Should the Mining Engineer Be Trained"; H. G. Moulton "Licensing the Mining Engineer"; Marion C. Rhodes, "What Can Legislation Do for the Mining Industries"; Samuel D. Nicholson, "The Need for a Department of Mines."

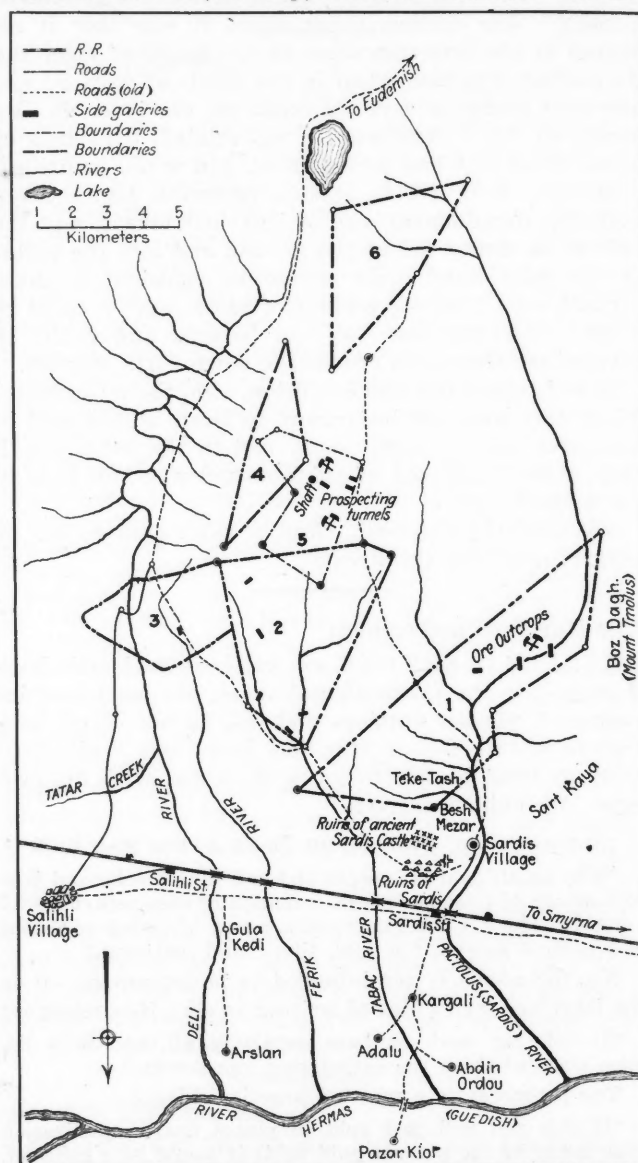
In our Market Section we will present forecasts for the coming year for each of the major metals by leading men in the metal markets. W. M. Foote will present "Marketing Non-Metallic Minerals" and A. R. Ledoux "The Metal Marketing Problem for the Miner." R. B. Ladoo will cover "The Future of the Non-Metallics." Our statistical tables and charts will be found in this section.

This unusual and complete number will be our issue of Jan. 21, 1922. It should be in the hands of every mining man and everyone interested in the mining industries. Place your orders for copies early, as the number we will print is limited closely to our normal requirements.

WHAT OTHERS THINK

Gold Mines at Sardis

Referring to the article "Mining as Seen by Herodotus" in the Oct. 15 issue of *Engineering and Mining Journal*, I would call attention to the fact that the gold mines at Sardis (see map) were not exhausted at that



time. Analyses of the ores of the district show the following gold content: Average sample No. 1, taken from the shaft and being quartz with iron pyrite, contains 5 gr. gold to the ton; average sample No. 2, taken from the different tunnels around the shaft and being chiefly iron pyrites, contains 9.87 gr. gold to the ton; medium sample No. 3, taken from galleries along the Pactolus River and being chiefly ochre, contains 25.29 gr. gold to the ton.

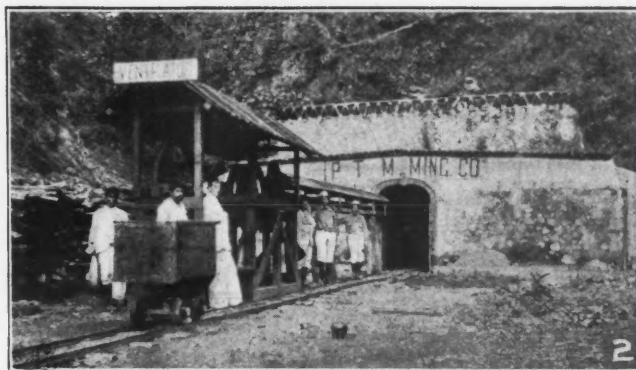
It is unfortunate that these mines are not still being worked. This is due to lack of capital and to the World War, during which the Greek and other Christian owners of these mines were forbidden to do any work whatever.

P. A. GEORGIADIS.

Constantinople.



1. ENTRANCE TO VETA GRANDE MINE, IN NAYARIT MOUNTAINS, MEXICO, SHOWING DRY MASONRY BUILT BY INDIAN LABOR



2. PORTAL AT MONJARAS MINE, SHOWING FAN.
3. TYPICAL MINING CAMP IN NAYARIT MOUNTAINS, STATES OF JALISCO AND NAYARIT



Recent Developments in Mining in Jalisco And Nayarit, Mexico

Great Activity Evident—Railway and Road Building in Progress—A Route Shorter Than Via Panama—Mining Camp Being Reopened—Geology Complex—Glimpses of Native Life

BY HENRY M. PAYNE

Written for *Engineering and Mining Journal*

THE CHANGE from paper to metallic currency in Mexico and the slowly rising price of silver have resulted in marked activity in the mining states of the republic. This is especially true in those districts which until recently have been inactive on account of bandits and revolutions. The present government seems to have been markedly successful in re-establishing industry and in putting down brigandage, so that a general air of stability and confidence prevails. Regular deliveries on an order for ninety locomotives are being made to the National Railways, and orders have been placed for 150 passenger cars, 3,000 freight and ore cars, and 25,000 tons of heavy steel for use on the main lines.

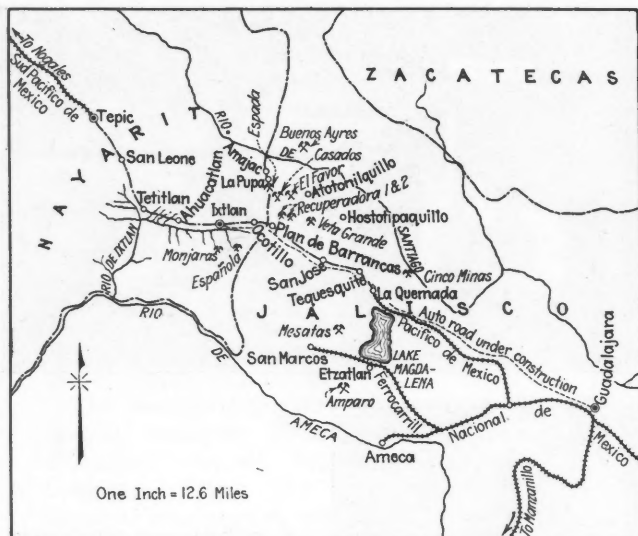
Probably the greatest activity in the republic is in the states of Jalisco and Nayarit. The last-named state was formerly the Territory of Tepic. The Southern Pacific Railway of Mexico extends from Nogales to Tepic City, on the west coast, through Guaymas and Mazatlan. For some time trains have been operated only north of Ruiz, on account of the destruction of the Santiago River bridge by bandits. This has now been rebuilt and over 2,000 men are employed on the extension of the line from Tepic towards Ixtlan del Rio.

Ixtlan del Rio, a city second in size only to Tepic, the capital, is the principal merchandising center of a vast mining area in the Nayarit Mountains, whose summit

forms the boundary between the states of Jalisco and Nayarit. Excellent stores, a municipal lighting plant, schools and residences make it the only modern town between Tepic and Guadalajara. The approach to the city from the east is over the old military road built by Santa Ana and rebuilt by Maximilian. Hidden in the clouds directly back of the city is Mount Ceboruco, an extinct volcano. Leading into the city from the south across the Ixtlan River is the road from the Monjaras and Española mines. An excellent stone bridge built by the Spaniards was dynamited about six years ago, so that it is now necessary to ford the river.

On the southern end, the Southern Pacific Railway of Mexico has a line in operation from Orendain Junction, where connection is made with the National Railways for Manzanillo and Guadalajara. The present westerly terminus of this line is La Quemada, on the north shore of Lake Magdalena, which point the Tepic-Ixtlan extension will ultimately join. When this link, approximately 100 miles long, has been completed, the commerce routes of North America may undergo some startling revisions. There will then exist a continuous trunk line from Seattle, Wash., to Mexico City and Vera Cruz, with direct steamer connection for New York, offering a far shorter and quicker route than through the Panama Canal.

There is no region of the tropics in the Western



MINING REGION OF NAYARIT AND JALISCO IN NAYARIT MOUNTAINS

Hemisphere where climate, elevation, and soil are more admirably combined for the production of fruit and food, sugar cane and vanilla beans, where frost is unknown and labor abundant, than the district under review. The crossing of the Nayarits, however, is one of heavy construction and tunneling and although many thousands of tons of steel and other construction supplies are at La Quemada, it will be at least three years before the gorges or *barrancas* at the head of the Amajac River have been crossed.

To provide for earlier transportation facilities to the mining districts, the governments of Jalisco and Nayarit are now building an automobile road fifteen meters wide between Guadalajara and Ixtlan del Rio, on which only automobiles and automobile trucks will be permitted, toll gates being established at intervals. The ox team and native plow, which is somewhat like a single-toothed harrow, are used to loosen up the surface, after which a group of laborers with shovels and wheelbarrows complete the grading. One of the first imports into Mexico should be modern agricultural implements and tractors. The accompanying map shows the projected railroad line and the new state highway through this district.

EARLY SPANIARDS OPERATED IN NAYARIT, ACCORDING TO HUMBOLDT

Referring to Mexico as the "treasure house of the world," Baron von Humboldt, in 1803, mentioned the Nayarit Mountains as the source of much of the wealth which supported the Spaniards for the three centuries from 1521 to 1821. Prior even to this, the Aztecs had worked these deposits, and from the ores so obtained many large gold and silver vessels and ornaments were made, to fall subsequently into the hands of the Spaniards. Mining methods were necessarily crude, with the result that on many properties today excellent returns are had from reworking abandoned tailings.

A few years ago there were found in the church at the Indian village of Hostotipaquillo parts of a Spanish manuscript written by a priest in Valera, who was in Mexico at the time of the Conquest. The first part was historical and described various geological changes in Yucatan, Panama, and Mexico, and also mentioned the burial mounds near Ixtlan del Rio and Soatlan. These mounds have since been opened and found to con-

tain hieroglyphic tablets, golden ornaments, silver utensils, and the skeletons of early rulers.

The second part described many mines in what are now the states of Sonora, Zacatecas, Jalisco, and Nayarit, but gave no definite locations of the properties. About three years ago, in the same Indian village, a third portion of this manuscript was found, which detailed the exact location of the original workings of six extremely rich mines. To date, four of these have been relocated and are now being opened up by American engineers and capitalists. All are within a few miles of one another in the main dividing ridge between the Ixtlan and Amajac rivers, which flow into the Ameca and Santiago, respectively.

RAIL TRANSPORTATION AVAILABLE FOR THESE PROPERTIES

Upon the completion of the railroad and automobile road already referred to, these properties and about six others, now operating, will all be directly upon or within close haulage distance of direct transportation to Guadalajara. At present, ore and bullion are sent by pack train to San Marcos and La Quemada and thence by rail.

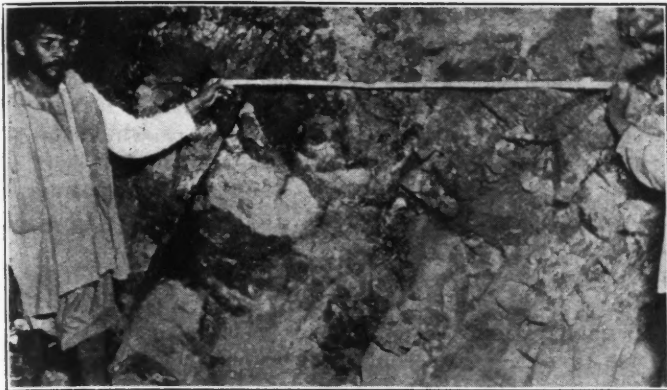
The mineralization of this region is unique and consists of five parallel veins and four intersecting veins, one of which is so wide that it has been named the Humboldt vein, after the famous geologist. On the southwest side of the mountain are the Falls of Monjaras, a Mexican Yosemite. At the base of this waterfall the Humboldt vein is exposed transversely, and extends in width between the two handkerchiefs as seen in the illustration.

AN ANTIGUA RELOCATED

The Spanish description of one of the old properties located it as being near these falls. A minute search of the entire mountain side eventually brought to light



INDIAN CARRYING MINE TIMBER UP MOUNTAINS



LARGE SILVER VEIN IN MONJARAS TUNNEL

old tailings, overgrown with the tropical vegetation of centuries, and further investigation uncovered a series of openings in the Fragua vein, extending about 300 ft. into the mountain.

The geology of the region is decidedly complex. The original stratigraphy was regular and clearly defined over the entire area, previous to volcanic disturbance. When the great eruptions took place these sedimentary layers were uptilted, until they now maintain almost vertical positions. The breakage, however, has been in gigantic areas rather than localized, with the resulting parallelism which forms whole mountains of uninterrupted strata. Subsequent erosion has exposed intrusive eruptive cores carrying uniformly high values and sharply defined foot and hanging walls. The andesites, diorites, and porphyries are typical of the igneous formations usually found in volcanic regions.

Gold, copper, and zinc occur in limited quantities, but the silver ores predominate, usually as argentite, cerargyrite, or native silver. These deposits are so

extensive and the outcrops so continuous that a single vein may be traced from mountain to mountain. In one occurrence the knobs of three successive hills are formed by one vein.

One of the illustrations shows a flashlight in the main tunnel at the Monjaras mine. The hanging wall and a portion of one of the wide veins may be seen. Ventilation is obtained by a gasoline-driven fan connected to an 18-in. pipe which carries the air in to the face, as shown in another view. Labor is everywhere abundant, and in general it may be said that the Mexicans and the Indians of the west coast make excellent workmen. They are skilled equilibrists and carry prodigious loads for long distances up steep mountain trails. A view of an Indian carrying a stick of timber up a mountain is shown. Timbers of this size are frequently packed in this manner for miles.

On account of the climate, the item of miners' houses is a small one. Grass and bamboo pole houses as shown in the accompanying view of a mining camp cost about \$50 Mexican or \$25 gold, and serve whole families. The cooking is done on an open fire out of doors, and the food consists principally of *tortillas* and *frijoles*, with occasional venison, wild turkey, or goat meat. The miners wear light cotton clothing when exposed to the sun, but underground the "gee" string of the tropics is the usual dress.

LA PUPA, AN ABANDONED CAMP

The vicissitudes of small mining camps during the succeeding Villista-Carranzista raids form interesting history. On the lower Amajac River the town of La Pupa was an enterprising mining settlement ten years ago. As a result of a series of raids, however, the mines were closed, and the mill, church, and village abandoned. Today the main street is overgrown with weeds, the



1. MAIN STREET, LA PUPA, NAYARIT MOUNTAINS, ABANDONED SIX YEARS AGO AFTER VILLISTA RAIDS. 2. PREPARING SAMPLES FOR ASSAY. 3. MINERS COMING OFF SHIFT. 4. AT FOOT OF MONJARAS FALLS; TWO HANDKERCHIEFS DENOTE WIDTH OF HUMBOLDT OUTCROP.

houses are deserted, and the church is in ruins. Along the roads in all directions may be seen wayside crosses where victims of the raids met their fate and were buried.

EARLY SPANISH INFLUENCES PERSIST

An interesting sidelight on Mexico is the persistence with which the religious teachings of the early Spanish priests have been transmitted from generation to generation among the Huichole Indians. It is most unusual for an Indian, even today, to pass one of these mounds without removing his sombrero, and if on foot depositing another stone and saying a prayer as he passes. The trails (for there are no roads) become densely overgrown in a fortnight, especially during the rainy season, and it is necessary to take along one or two extra *mozos* to clear the path with machetes.

At La Venta, on the summit of the Nayarits, is an old hotel. In the plaster around the patio may be seen the marks of the bullets of the firing squads that infested the district during the revolutions.

The new automobile road, when completed, will be one of the scenic highways of the world. Varying in altitude from 7,000 to 11,400 ft. and embracing the vast watershed of the Santiago River system, the traveler is greeted by a continuous panorama. Many varieties of cacti abound, the most beautiful of which is the "organ" cactus which attains tree height. At the Recuperadora mine, one of these plants, growing up through the ore dump, forms a prominent landmark.

The native Mexican, like his Indian co-laborer, has no use for chairs or tables, but squats with aboriginal comfort. In one of the views may be seen the engineer's assistants "bucking" samples of ore in preparation for assay.

CONDITIONS IN MEXICO, IN GENERAL, IMPROVED

As a result of my investigation of economic conditions in Mexico, it would appear that our sister republic is today in better condition than for some years. Weary of fighting, anxious to settle down to work and food, the native Mexican has learned a valuable lesson in citizenship; he is beginning to realize that he who will not work cannot eat.

Many problems of reconstruction, of finance, of taxation, of international relations, remain to be worked out. But good will is everywhere evident, and the improvement in railroad service and equipment, the building of automobile roads, and the continued operation of such mines as the Cinco Minas, El Favor, Amparo, Casados, and Mesatas, during all the troubled period, indicate a confidence in the future which is probably not misplaced. With the downfall of Russia and consequent inaccessibility to Siberian mineral wealth, it is probable that additional American capital will seek investment in Mexico.

Bureau Testing Low-Grade Silver Ores

Microscopic studies of the low-grade silver ores from the Ontario mine at Park City, Utah, made at the Inter-mountain Experiment Station of the Bureau of Mines have given information that is expected to be of considerable value in devising means for effecting a satisfactory recovery of the lead and silver in this type of ore, which is typical of a large tonnage of similar material in the Park City district that has been very difficult to treat.

Production of Tin in Burma

"The annual production of tin in the world prior to the war was from 120,000 to 125,000 tons, and as far as can be gathered, the average annual production for the three years ended 1916 was 123,000 tons, of which the British Empire produced 54.5 per cent," says the *Chamber of Commerce Journal* (London) in quoting from an article in the "Bulletin of Indian Industries and Labor." The Federated Malay States furnished the largest contribution both to the empire and to the world's supply, and in 1918 the output amounted to 37,370 tons. For the same year it is estimated that Burma turned out ore containing at least 1,261 tons of metallic tin. The imports of tin into India during 1918 were 1,299 tons.

This shows, says the *Journal*, that Burma is capable of producing sufficient tin to make the Indian Empire self-supporting as regards this metal, provided the ores be smelted in India. Continuing, the *Journal* points out:

"The potentialities of the Tenasserim division of Lower Burma as a tin-producing region are fairly well known, but much remains to be done in the better equipment and further development of the deposits. Alluvial deposits especially offer attractive possibilities, and the officers of the Geological Survey of India have repeatedly drawn attention to areas which they considered worth the cost of testing. In the more isolated portions of Amherst, Tavoy, and Mergui districts, lying between the regions where deposits of both tin and tungsten ores are worked, the searches of the prospector should be especially directed to the margins of the great granite intrusions for veins carrying cassiterite, and to the valley gravels and sands of the middle and lower courses of the streams which drain them for alluvial deposits of tinstone."

Tin Exports From Federated Malay States

In September, 1921, 2,338 tons of tin was exported from the Federated Malay States, as against 3,051 tons in August, according to data supplied by the Malay States Information Agency to the *London Chamber of Commerce Journal*. The total exports of tin from Jan. 1 to Sept. 30, 1921, amounted to 25,050 tons, which is a small decline from exports for the two preceding years, as shown by the following table:

Months	1919 Tons	1920 Tons	1921 Tons
January.....	3,765	4,265	3,298
February.....	2,734	3,014	3,111
March.....	2,819	2,770	2,190
April.....	2,858	2,606	2,692
May.....	3,407	2,741	2,884
June.....	2,877	2,940	2,752
July.....	3,756	2,824	2,734
August.....	2,956	2,786	3,051
September.....	3,161	2,734	2,338
Totals.....	28,333	26,680	25,050

Lead Mining Active in Swatow District

The Chuling mining works, which is operating a lead mine in Chenping district, recently made its first shipment of lead, according to Consul M. S. Myers at Swatow, China, in *Commerce Reports*. Smelting by native methods is carried on at the mine, the present capacity of the furnaces being three short tons per day. It is planned to double this furnace capacity at an early date. A high-grade soft lead, running between 99.97 and 99.98 per cent pure, is produced. It is shipped in slabs weighing 140 cattles (about 187 lb.) each. About 115 short tons has already been exported. A ready market for this product is found in South China.

The Hollinger Mine

Ranks With New Modderfontein and Government Areas Among the World's Leading Gold Producers

BY ALEXANDER GRAY

Written for *Engineering and Mining Journal*

THOSE INTERESTED in the relative standing of the world's largest gold mine will appreciate a review of the details of the work at the Hollinger in 1921, and a comparison of the status of Canada's premier gold producer with the New Modderfontein and the Government Areas, in the Witwatersrand, which, with the Hollinger, comprise a trio of the three greatest mines of their kind. Each company mills more than a million tons a year. So close is the contest for leadership in output that the final Hollinger figures will be necessary before either of the trio can be awarded the "Medal of Honor, With Palms."

Given immunity from power shortage, Hollinger Consolidated in 1921 may crush sufficiently more than a million tons to exceed the total of 1,083,000 reported by New Modderfontein for the year ended June 30. If that total is passed, the Canadian company will be in the lead as to the tonnage milled. Whether or not it will rank first as to profits from mining and milling operations—apart from the premium upon gold—cannot be determined until the Hollinger annual report is forthcoming. At any rate the working revenue of the Hollinger—including the gold premium—would top the score were the premium upon Canadian gold the same as was realized by the two outstanding Witwatersrand companies. The bonus obtained by New Modderfontein over the standard price for gold in the year ended June 30 was 44.2 per cent, whereas the Hollinger premium in this calendar year may be about a quarter of that figure.

In point of tonnage milled in a year, as between the Hollinger and the New Modderfontein, operating results necessarily are contingent upon the grade of ore treated. The 1920 Hollinger average was \$9.93 per ton. The New Modderfontein average for the year ended June 30 was almost the same. Seemingly the New Modderfontein production was about \$10,600,000. But the Hollinger 1921 grade hardly will be maintained at the 1920 average; consequently the grand total of its production for this year may not attain to that of New Modderfontein. However, as Hollinger costs are lower than those of New Modderfontein were last year, the indications are that the Hollinger profits will be larger this year than those of its South African compeer in 1920-21.

That being so, with the milling record within reach of Hollinger—if not actually secured—and with the company's current profit, not counting the premium, at the head of the list, the comparative ore-reserve position of the respective companies is of interest. In June, New Modderfontein ore reserves were estimated at 8,884,600 tons of 8.4 dwts.—say \$76,000,000. Development is proceeding with satisfactory results, the ore extracted being more than replaced, for the time being. That part of New Modderfontein area that remains undetermined affords a further speculative factor—no doubt of ample proportions—whereas Hollinger vein structures do not lend themselves so readily to estimates beyond known quantities, however confident may be the management that the upper work-

ings of the mines are far removed from exhaustion.

Not long ago a responsible member of the staff told the Hollinger directorate that if he was given another thousand men the management could be profitably employed for five years in the development and mining of the section above the 425 level; that a further five years with a correspondingly large crew could be devoted to lower levels, and that the 1,250 level would be ready for stoping in a third five-year period. After two years had elapsed, the management, at the end of 1920, admitted there was 3,063,153 tons above the 800 level, of which 1,433,400 tons was above the 425 level, and that estimate set aside all ore of \$6 and under.

At the close of the ninth year of crushing, when labor was scarce, it was necessary last year to mine, below the 425 level, only 261,377 tons of the 649,013 tons milled. Assuming that the greater part of the tonnage milled continues to come from the upper levels, the fact that there is nearly as much ore in reserve above the 200 level as is allotted to the section below the 800 level suggests more than need be assumed.

Perhaps a better index to the attitude of the Hollinger directorate and management is their fixed purpose to increase their milling capacity to the extent of a further 2,000 tons per day. New Modderfontein's crushing capacity now is 105,000 tons per month. Latterly, the Hollinger has exceeded this, a stamp duty of as high as seventeen tons a day being a measure of operating efficiency. This became possible by the installation of secondary crushing facilities, rolls, and ball and tube mills, demonstrating that on such ores the use of stamps hereafter can be discontinued.

General Manager Brigham is fully convinced that stage crushing of the newer sort as practiced at other plants in the Ontario North Country will obviate the more expensive installations adopted by the Hollinger and Dome companies. Before Hollinger has increased its milling output, though, more tanks will have to be provided and other metallurgical features augmented. Meanwhile, and of acutely urgent importance, is the matter of an assured supply of hydro-electric power. As it is, costs are high and must be brought down if Ontario gold mines are to operate advantageously.

Unfortunately, an agrarian provincial government fails to recognize the relationship of such mines to the common weal. To crush a million to a million-and-a-half tons annually is an undertaking of magnitude. Adequate power is a prerequisite. Because the mines of the Hollinger company are capable of unprecedented production, and might ignore ordinary factors of costs, comparisons are somewhat disadvantageous for other companies by whom lower wages and cheaper supplies would be welcomed.

At the moment, the power problem is deterrent to further expansion. Otherwise, Hollinger properties in their upper levels demand aggressive development before deeper operations are extensively undertaken. Approximately half a million tons, worth about \$5,000,000, is broken in stopes. Therefore it rests with the government and power companies, and rational labor, to place the Ontario gold industry upon a firmer footing, a footing that will be a better incentive for the investment of more new capital throughout districts in which the precious metal is widely distributed. Few precious-metal mining companies can point to a combined liquid treasury and reserve of broken ore equivalent to 40 per cent of the nominal value of issued capital.

The Santa Barbara 500-Ton Mill for Concentrating Lead Carbonate Ores

Carefully Planned Flow Sheet at the American Smelters Securities Concentrator Provides Coarse Reduction in a Gyratory and Disk Crusher, Grinding in a Rod Mill, and Tabling of Closely Sized Pulp

BY FRED M. HEIDELBERG

Written for *Engineering and Mining Journal*

THE NEW MILLING PLANT of the American Smelters Securities Co. at Santa Barbara, Chihuahua, Mexico, with a daily capacity of 500 metric tons, has just been finished and is now being brought into co-ordinated operation. This plant was built to treat the carbonate ores of the mines in the district, besides several old and weathered mine and mill tailing dumps, and is supposed to embody all the improvements that modern milling practice affords for the treatment of this class of material. Lead carbonate is the principal constituent of value in the material to be treated. Gold and silver occur in small but paying quantities, and copper and zinc are present in minute amounts. The valueless material in the first ore to be treated is estimated to contain 60 per cent silica, 7 per cent lime, 9 per cent iron, and 3 per cent sulphur.

The determination of the flow sheet required much time and study. Representative samples were sent to the company's test laboratory and were subjected to every possible treatment that was considered of any value. A record of each test was systematically kept, and smelter balance sheets were prepared from the results as though that class of product had actually been sent to the smelter.

It was not considered safe to construct a mill from the flow sheet of the test laboratory, for conditions there were more nearly ideal than would obtain in a large mill. Consequently, a large shipment of this same ore was sent to the company's test mill, so that a continuous test of several weeks could be made under as nearly actual operating conditions as possible. The test mill was so arranged that the ore would be treated with the same flow sheet as was found most desirable in the test laboratory. The results of the test mill then gave reasonable assurance that the same results could be obtained in a mill under actual operating conditions, and that the experimental flow sheet could be adopted on a large scale. The final mill flow sheet was then formulated, in which was determined the number of machines required to handle the tonnage to be treated under each operation. This flow sheet is shown in Fig. 1.

Special attention is called to the method of obtaining the tonnages of the fine-grinding department. Here, there is an accumulated return to the rod mills from the screen oversize. To determine the amount of this return, several assumptions were made. First, that all ore be crushed to minus 2 mm. Second, that the

TABLE I. ELEVATOR DATA

Elevators	Material				Belts		Buckets (18-In. Apart)						
	Solids in 24 Hours Metric Tons	Cu. Ft.	Water in 24 Hours Metric Tons	Cu. Ft.	Total Material Cu. Ft. in 24 Hours	Cu. In. per Min.	Size, In.	Speed per Min., Ft.	No. per Min.	Size, In.	Volume Cu. In. as Listed	Av. Vol. Cu. In. Material Elevated per Bucket	Percentage Av. Volume Material Elevated per Bucket to Volume as Listed
Screen oversize (2)	670	14,740	968	34,074	48,814	58,579	2-14	390	520	12x6x6 $\frac{1}{2}$	246	112	45.6
Screen undersize (2)	525	11,550	2,100	73,920	85,470	102,564	2-18	390	520	16x7x7 $\frac{1}{2}$	467	197	42.2
Sand tailing (2)	285	6,270	2,321	81,699	87,969	105,563	2-18	390	520	16x7x7 $\frac{1}{2}$	467	203	43.0
Slime (2)	180	3,960	720	25,344	29,304	35,165	2-14	390	520	12x6x6 $\frac{1}{2}$	246	68	27.7
Sand middling (1)	40	880	120	4,224	5,104	6,125	1-18	390	260	16x7x7 $\frac{1}{2}$	467	24	5.1
Concentrate (1)	67	1,072	353	12,426	13,499	16,198	1-18	390	260	16x7x7 $\frac{1}{2}$	467	62	13.3

Weight of ore = 100 lb. per cu.ft. = 22 cu.ft. per metric ton.
 Weight of water = 62.4 lb. per cu.ft. = 35.2 cu.ft. per metric ton.
 Weight of concentrate = 137.5 lb. per cu.ft. = 16.0 cu.ft. per metric ton.

TABLE II. MOTOR LIST

Location	Machines Driven	Total Est. Hp. Req'd.	No. of Motors	Rated Hp.	R.P.M.		Pulley	Frame No.	Type	Form
					No. Load	Full Load				
Head of Conveyor No. 1	Conveyor No. 1	8	1	15	900	865	10x6 $\frac{1}{2}$	322	KT	B
Crushing plant	No. 5 gyratory crusher, 48-in. Symons hor. disk crusher, conveyor No. 2 and shafting	30 } 60 } 10 }	1	100	720	690	21x9	15	I	K
Fine-ore bins	Conveyor No. 3	15	1	25	720	690	13x9 $\frac{1}{2}$	336	KT	B
Fine-crushing floor	{ Belt feeder and shafting 4 } { 2 trommels 4 } { 2 Duplex shovel wheels 4 }	4 } 4 } 4 }	1	15	900	865	10x6 $\frac{1}{2}$	322	KT	B
Rod mills	2 5x10 rod mills	180	2	100	600	570	18x17	15	I	M
Upper elevator and screens	{ 8 Cole screens 8 } { 5 elevators 50 }	8 } 50 }	1	75	720	690	16x17	14	...	...
Table floor	{ 1 mech. split. and line shafts 15 } { 30 Deister tables and shafting 24 }	15 } 24 }	1	25	720	690	13x9 $\frac{1}{2}$	336	KT	B
Lower elevators	{ 5 elevators 50 } { 10 Deister tables 7 } { 2 mech. split. and all shafts 15 }	50 } 7 } 15 }	1	75	720	690	16x17	14	...	...
Sand tables	1 class "C" Duplex classifier	5	1	10	900	865	8x5 $\frac{1}{2}$	312	KT	B
Pump house	4 centrifugal pumps	20	4	15	900	865	Direct.	322	KT	B
	1 centrifugal pump (return water)	5	1	10	900	865	14x7	312	KT	B
	3 50-ft. Dorr thickeners	6	3	3	1,200	...	4 $\frac{1}{2}$ x4 $\frac{1}{2}$	160	KT	B
Incline tram	Incline tram	...	1	22	900	865	.....	10	I.T.C.	M

of water per minute to tons of ore in circulation is 2.55.

An elevator data sheet, as shown in Table I, was formulated from the mill flow sheet and the water flow sheet. The cubical contents of both the ore and the water in the pulp were used in obtaining the capacities of the elevators. The weight of the solids, or ore, was figured at 100 lb. per cubic foot, or 22 cu.ft. per metric ton, and water was figured at 62.4 lb. per cu.ft., or 35.2 cu.ft. per metric ton. Concentrate was figured at 137.5 lb. per cu.ft., or 16 cu.ft. per metric ton.

The motor list had to be prepared ahead of the usual time, because of poor deliveries of that class of electrical material at the time this mill was designed. A tentative sketch of the proposed mill was made, to get the proper grouping of machines to be driven by each motor. Table II shows this motor list as it was prepared; is an excellent reference sheet, giving all the necessary information in an easily obtainable form. The probable horsepower of each machine is recorded, besides all information describing the motor.

After the preliminary work just described had been done, the results were given to David Cole, a consulting engineer of El Paso, for use in designing the mill. Mr. Cole is a veteran in milling practice, and there are few mills in the Southwest that do not bear some evidence of his influence.

The general layout of the entire plant is shown by Fig. 4, which gives the relative position of all departments entering into the treatment of this ore, besides many dimensions that may be of value to the reader. All dimensions are given in feet and inches, and all elevations in meters. The mill proper is shown in plan by Fig. 5 and in elevation by Fig. 6. These drawings will enable the reader better to understand the more detailed description of the various departments of the mill that follow.

The ore is brought from the mines and dumps in the regulation ten-ton side-dump cars, on a narrow-gage track that leads over the receiving bin. This bin, shown in Fig. 7, is of concrete and is of flat-bottom construction, with inside dimensions 17 ft. wide, 13 ft. high, and 60 ft. long. The wall is a tapering reinforced concrete slab 4-in. thick at the top and 9 in. at the bottom. This slab is supported every 15 ft. by reinforced beams 15 x 22 in., with a tiebeam across the

top which is of sufficient strength to carry the ore trains. Parts subjected to wear will be provided with a timber protection. Eight openings in the bottom of the bin feed the ore into a traveling hopper which delivers it on to a 24-in. belt conveyor, the head end of which discharges the ore into the coarse-crushing plant.

The coarse-crushing plant consists of a building 77 ft. long by 30 ft. wide, in which are the No. 5 McCully gyratory crusher and the 48-in. Symons horizontal disk fine-reduction crusher. The basement contains the crusher discharges and the drives. The operating floor is proportioned to provide for the repair of the crushers. Trolley beams and chain blocks over the crushers are provided to facilitate the moving of heavy parts.

The 24-in. conveyor from the receiving bins feeds the ore on a standard bar grizzly, set for 1½-in. product.

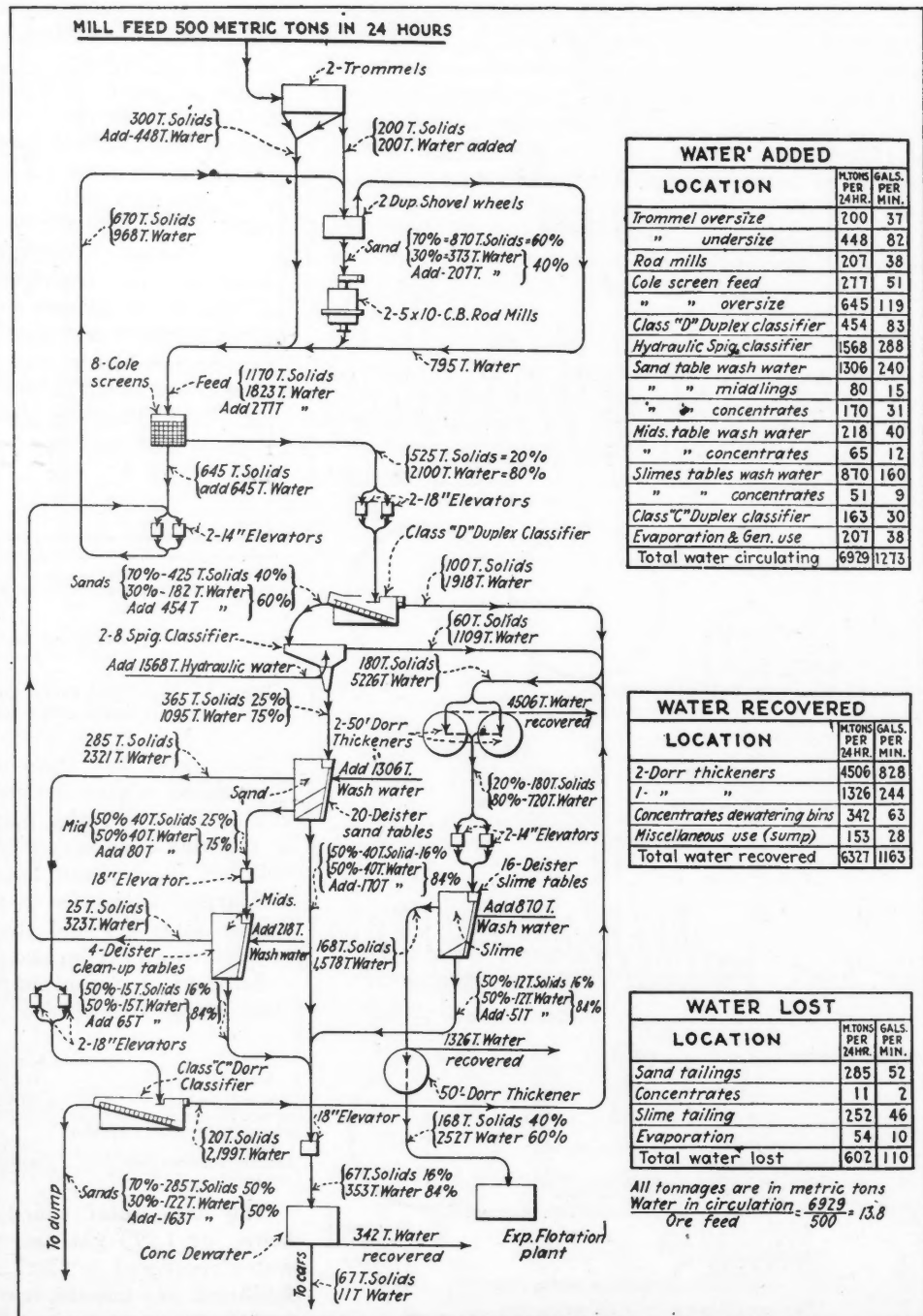


FIG. 3. WATER FLOW SHEET AND SUMMARY

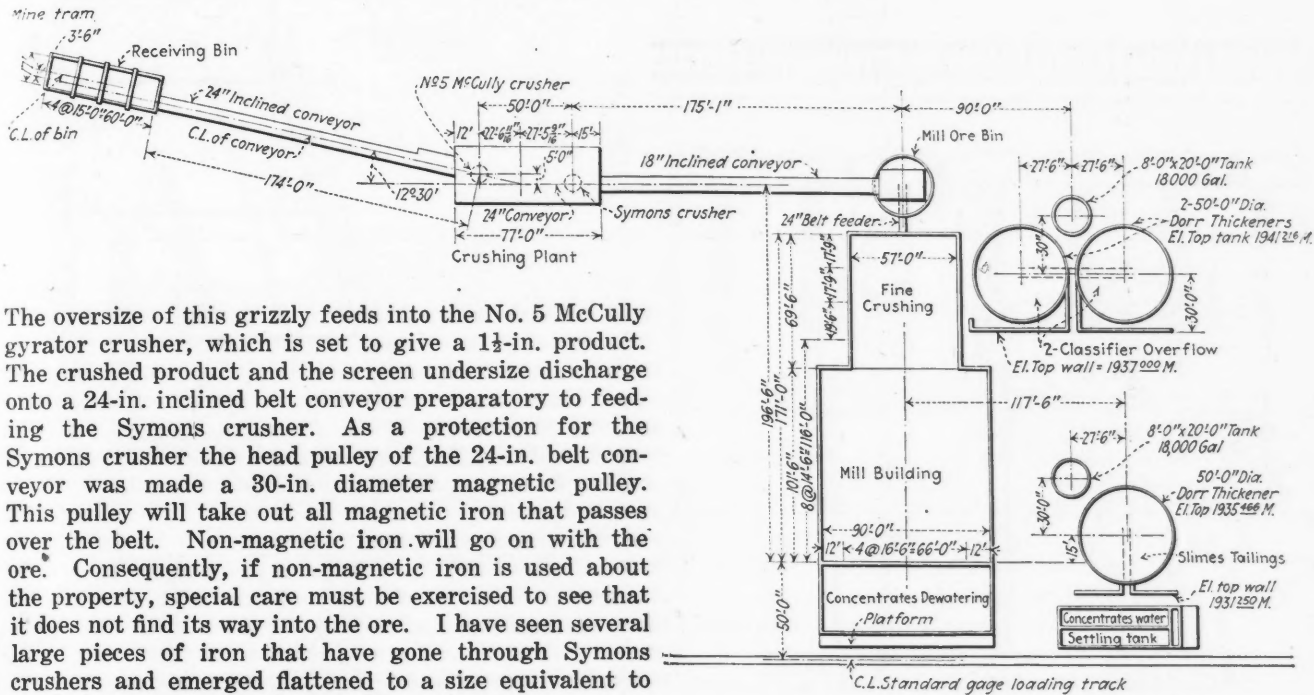


FIG. 4. GENERAL LAYOUT OF MILL

The oversize of this grizzly feeds into the No. 5 McCully gyrator crusher, which is set to give a 1½-in. product. The crushed product and the screen undersize discharge onto a 24-in. inclined belt conveyor preparatory to feeding the Symons crusher. As a protection for the Symons crusher the head pulley of the 24-in. belt conveyor was made a 30-in. diameter magnetic pulley. This pulley will take out all magnetic iron that passes over the belt. Non-magnetic iron will go on with the ore. Consequently, if non-magnetic iron is used about the property, special care must be exercised to see that it does not find its way into the ore. I have seen several large pieces of iron that have gone through Symons crushers and emerged flattened to a size equivalent to the space between the disks. The unnecessary wear on the disks and the probable damage to the bearings are sufficient reasons for taking precautions.

The plate screen takes its feed from the 30-in. magnetic pulley. This screen is nothing more than a manganese steel plate, full of 1½-in. holes. When inclined at 40 deg. this plate will give an undersize of minus ¾ in. The oversize from this screen feeds the 48-in. Symons crusher, the disks of which will be set to give a product of minus ½ in. if possible. The screen undersize and the crusher discharge fall on an 18-in. inclined belt conveyor which delivers the product to the mill bin.

REDWOOD TANK USED FOR MILL BIN

The mill bin is a departure from the ordinary bin construction, in that it is a redwood tank, 30 ft. in diameter by 24 ft. high, and is lined with timber to take the wear of the ore. On the bottom of this tank is a hopper with a gate through which the flow of ore is regulated to the belt feeder by means of a hand wheel on the hopper. The belt feeder is a short inclined 24-in. belt conveyor that discharges on to a hog-back splitter, one-half of the ore going to each of two trommels.

The trommels are of the revolving-screen type, 48 in. in diameter, and 6 ft. long. The screen is a plate with ½-in. punched holes, which will give a product of minus ½ in. The undersize goes to the Cole screens to be sized while the oversize goes into the duplex shovel wheel.

The duplex shovel wheel acts as a dewaterer and a chip screen. The construction is simple and inexpensive. If necessary it can be made by putting paddles on an ordinary pulley and placing it in a spitzkasten. In this particular operation the wheel was a special design of cast iron 30 in. diameter by 8 in. wide, with brackets to take the paddles, which were of ¾-in. plate by 10 in. wide. The spitzkasten was built of wood. Fig. 8 shows the general construction and detail of the shovel wheel. The overflow goes to the Cole screens, so that any slime may be saved, and the sand is fed direct to the rod mill.

The Cole-Bergman rod mill is 5 ft. in diameter by

10 ft. long. Although this mill is of a new design and few data as to its performance are at hand, Mr. Cole gave every assurance that a cheaper power cost could be obtained with this machine than with any other. This mill is to turn at 19.8 r.p.m., and is driven by a 100-hp. motor with a Lennox drive, which allows the motor to be placed within 5 ft. of the pulley on the rod-mill pinion shaft. The mill is to be operated under such conditions that it will grind to 50 per cent minus 2 mm., unless conditions warrant different results. It may be of interest to state that plain liners cannot be used in a rod mill, for the load will oscillate back and forth and wear out the liners in a few days. This actually happened when this mill first was started. A new design of liner, as shown by Fig. 9, with large offsets that would keep the load from oscillating, was then put in, and the trouble stopped.

The 2-mm. screening system consists of eight Cole oscillating screens. These screens are of low first cost, easily constructed and repaired, and are good screens when running wet, as the water is being constantly thrown against the bottom of the wire cloth, thus aiding in getting the particles through the mesh. The feed to these screens consists of the entire output of the rod mills and the trommel undersize. The undersize from these screens is elevated by two 18-in. belt elevators to a Class "D" Dorr classifier preparatory to tabling. The oversize is elevated by two 14-in. belt elevators and returned to the shovel wheels to be dewatered and ground further.

It is to be noted in Fig. 2 that of the trommel undersize of 300 tons, 225 are plus 2 mm. If this condition is approximated it will probably be better to screen the trommel undersize to minus 2 mm., and pass the plus 2-mm. product directly into the shovel wheel, or to replace the trommels entirely with 2-mm. screens and pass all the oversize into the shovel wheels. This will eliminate the elevating of 225 tons a day a distance of about 50 ft. by the two 14-in. elevators, will reduce the wear on the launder system, and also reduce the amount of water necessary to make this coarse material flow.

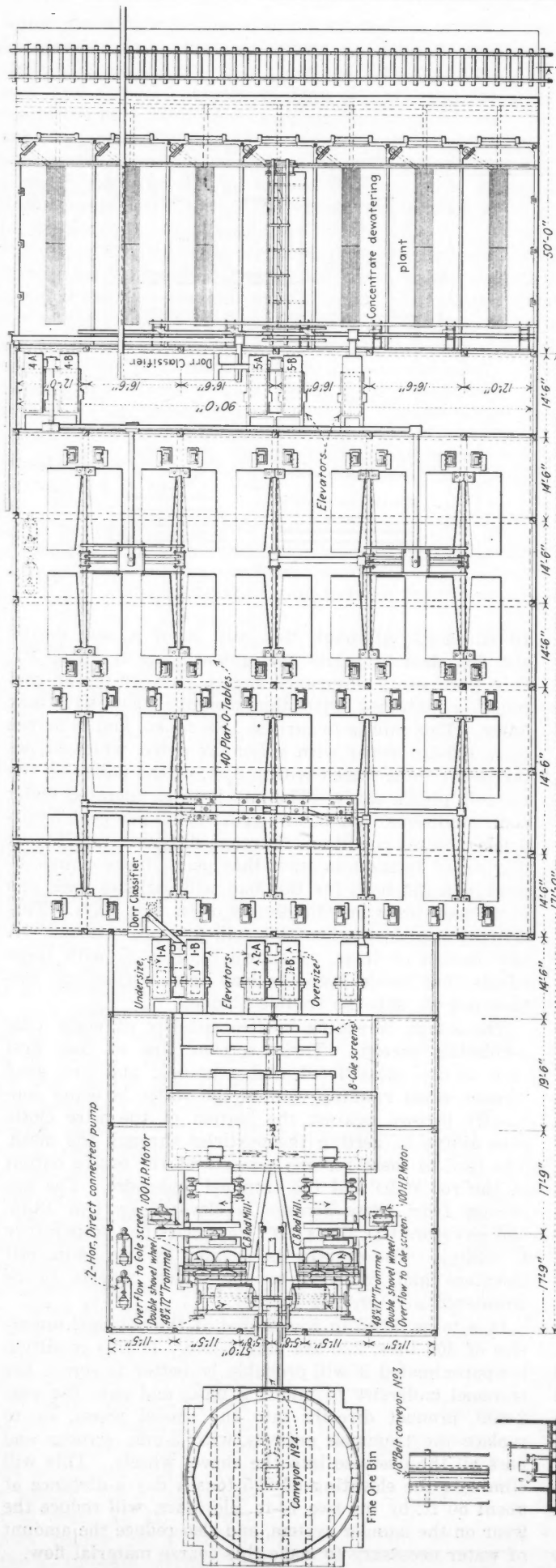


FIG. 5. PLAN SHOWING GENERAL ARRANGEMENT, CARBONATE MILL, SANTA BARBARA UNIT, AMERICAN SMELTERS SECURITIES CO.

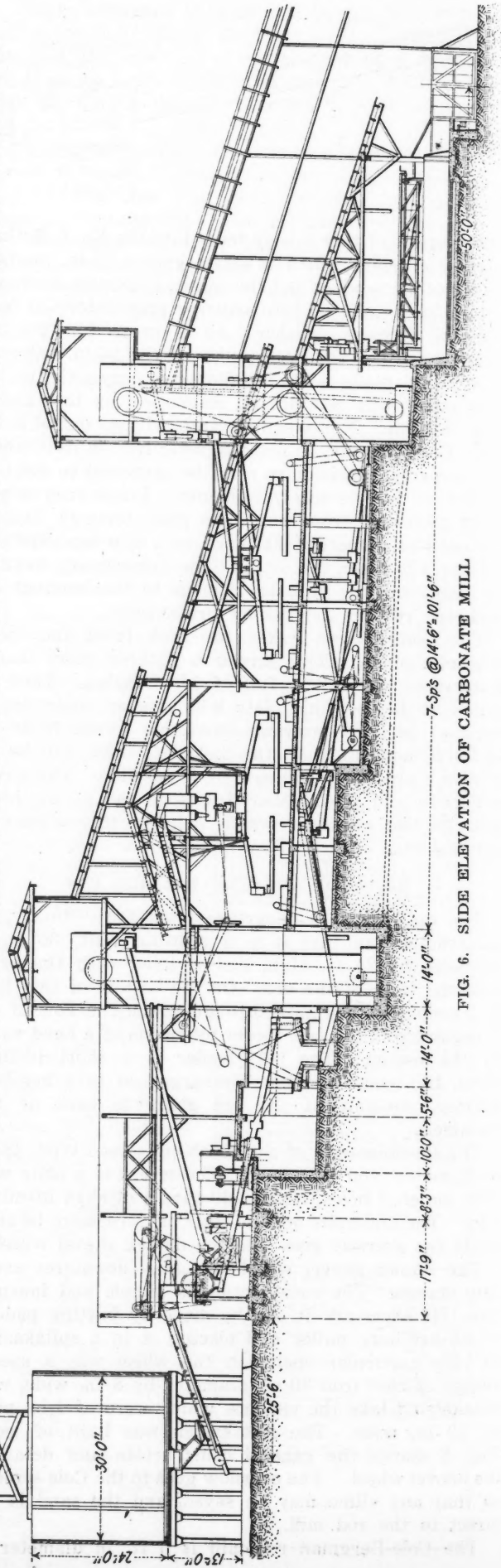


FIG. 6. SIDE ELEVATION OF CARBONATE MILL

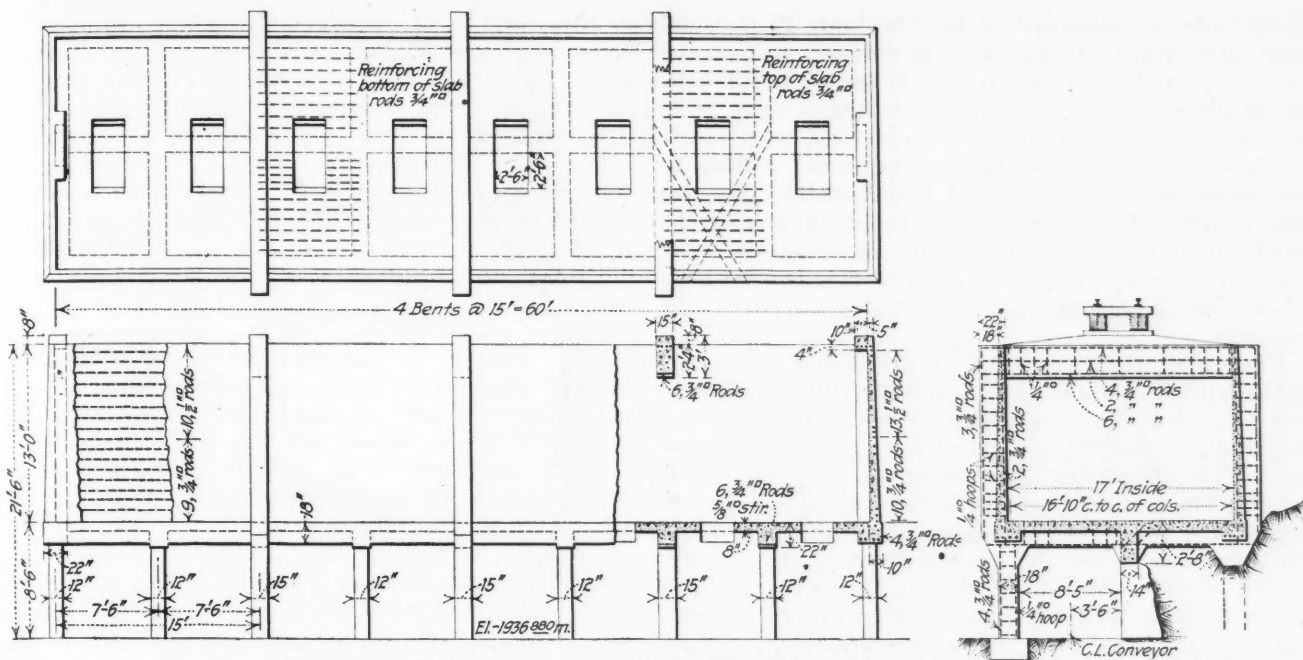


FIG. 7. DESIGN OF CONCRETE RECEIVING BIN

The classifying system for preparing the pulp consists of one Model "D" Dorr classifier and two launder classifiers each containing eight Deister hydraulic cone classifiers. The function of the Dorr classifier is to remove the slime from the pulp. The exact size of classification will be determined during operation. The sand from the Dorr classifier is fed into the launders to be sized by the hydraulic cone classifiers. About four sizings will be made. This was considered necessary, because experience in tabling has shown that the separation is better when the pulp fed to a table has narrow size limits. The overflow from the Dorr classifier and the launder classifiers is conducted to two 50-ft Dorr thickeners to be thickened preparatory to treatment on the slime tables.

The tabling system is the only means of separation originally intended for this mill. Three classes of material are to be treated by the tables—viz., sand, middling (in size), and slime. The Deister Plat-O table was chosen because the same table could be adapted to the treatment of these three classes of feed. It was therefore possible to simplify the scheme, besides reducing the expense of repair parts that would be necessary were several kinds of tables used. Right-and-left-hand tables were used to give a better grouping for a minimum space, and better operating conditions could be secured because of the reduction in the number of operating aisles.

The sand tables, twenty in number, receive their feed from the sized pulp from the classifier launder. The first sizing, representing the large particles, is fed to a four-way mechanical splitter, each split supplying material to a pair of tables. Thus eight tables are supplied with the first sizing. The second, third, and fourth sizings are each fed to a group of four tables by means of two half-splits. There are three products from the sand tables, concentrate, middling, and sand tailing. The tailing is elevated by two 18-in. belt elevators to a Model "C" Dorr classifier, the function of which is to dewater the tailing, besides reclaiming any slime that may be present. The classifier overflow goes to the two 50-ft. Dorr thickeners, and the sand is taken to a storage dump for probable future treat-

ment. The middling from the tables is returned to the rod mills to be reground, after it has been put over four middling tables, where any valuable constituents are removed.

The slime tables, sixteen in number, treat the thickened product from the two 50-ft. classifier-overflow Dorr thickeners. This thickened pulp is laundered to two 14-in. belt elevators that elevate it to a distributing launder. The pulp is halved to two four-way mechanical splitters, each cut of the splitter supplying a pair of tables. There are two products from these tables, concentrate and slime tailing. The tailing is to be thickened in a 50-ft. Dorr thickener, from which it will eventually be taken to be treated in an experimental flotation plant.

CONCRETE FILTER TANKS DEWATER THE CONCENTRATE

The concentrate dewatering system is worthy of note, as it is a departure from usual practice. It is situated at the lower end of the mill and consists of seven con-

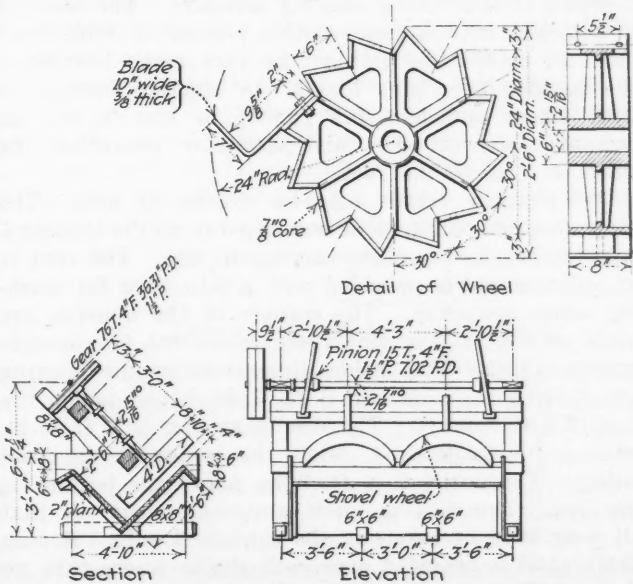


FIG. 8. DESIGN OF DUPLEX SHOVEL WHEEL

crete tanks, approximately 4 ft. 6 in. high, 12 ft. wide, and 35 ft. long. A steel door is provided in one end of each tank to allow concentrate to be taken out with wheelbarrows. The bottom is provided with a steel grating 3 ft. 2 in. wide by 28 ft. 2 in. long, upon which is placed coco filter matting for drainage. A filter is also provided in one corner of each tank to drain the water vertically. Outside these tanks is a concrete platform, level with the bottom of the tanks and even with the floor of railway cars on the loading track, which allows the concentrate to be wheeled directly into the cars.

The concentrates from the sand, middling and slime tables are all collected onto a shaking launder delivering to a short 18-in. belt elevator which elevates this material sufficiently to discharge it to a traveling launder. This distributes the concentrate over the seven tanks. The launder from the elevator extends over one end of the tanks, and at seven different points there are tongues to divert the concentrate from the launder to 4-in. pipes. These discharge into the traveling launder, so that any tank may be filled by setting the diverting tongue in the main launder to feed into it. The traveling launder is provided with six pipe discharges, so as to give an even distribution in the tank and not allow the concentrate to pile up in one spot. The end of this launder is open, making it possible for the concentrate to be deposited near the end of the tank.

The construction of the traveling feature of this launder is simple. The launder is supported on a pair of trusses, which are carried by a pair of crane wheels at each end. These wheels travel on 16-lb. rails supported on 6 x 8-in. beams spaced 29 ft. 8 in. centers. A crank and gear arrangement at one end provides the means for moving the traveling launder from one tank to another.

SUPPORT FOR SHAKING LAUNDER OF NOVEL DESIGN

The shaking launder, into which all concentrates gather, is a somewhat novel feature developed by experience. Fig. 12 shows the support of this launder as designed by Mr. Cole. A strap about the launder is bolted to a 1 x 8-in. maple board, which is reduced in cross-section both in width and breadth near the middle. This gives a flexible support for the launder and eliminates the endless trouble experienced in other methods of supporting shaking launders. The shaking is obtained with a head motion similar to table head motions, except that it must be very much heavier if the launder is of any length. A shaking launder is used where sufficient fall cannot be had to use an ordinary launder. In this particular operation the slope is $\frac{3}{8}$ in. to the foot.

The elevator details may be worthy of note. The same general specifications were used in all the elevators, only the belt and buckets varying in size. The boot is of concrete and is provided with a 6-in. pipe for washing when necessary. The corners of the housing are made of 2 x 12's, to which are nailed the tongue-and-groove siding. The inside dimensions of the housing are 2 ft. 8 in. wide and 6 ft. 7 in. broad inside the 2 x 12's at corners. The discharge box is 3 ft. 2 in. wide and extends 6 ft. below the center of the head pulley. The outlet is 1 ft. 9 in. above the bottom of the box. This box is made unusually large, so that all wear may be taken by the contained pulp. A pulp drain shed is provided over both shafts where they go through the housing, to keep the shafts clear of water

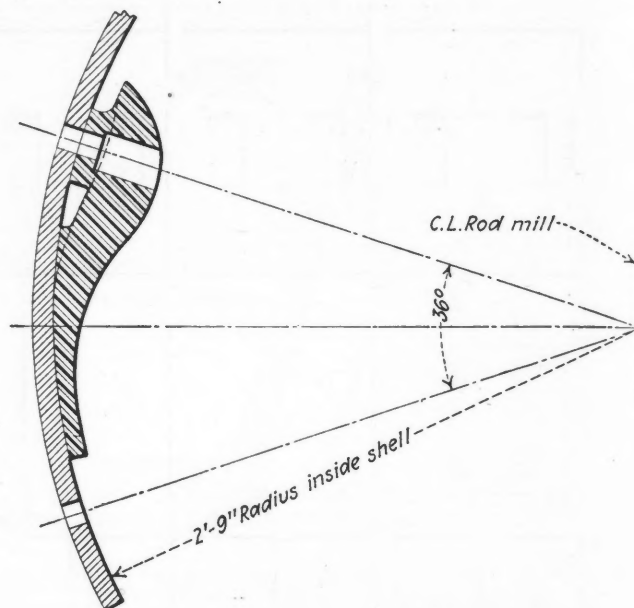


FIG. 9. CROSS-SECTION OF MANGANESE-STEEL LINER FOR 5 x 10-FT. COLE-BERGMAN ROD MILL

and sand. All head pulleys are 48 in. in diameter, $\frac{5}{8}$ in. crown, with a 3-in. flat space on face on center of pulley, and are keyed to a 4 $\frac{1}{2}$ -in. x 7-ft. 2-in. shaft by two 1 $\frac{1}{2}$ x $\frac{3}{4}$ -in. keys placed 120 deg. apart. Bearings were provided on 10 x 12's spaced 4 ft. 6 in. centers. All tail pulleys are 36 in. in diameter, with a $\frac{3}{8}$ -in. crown, and flat space of 3 in. on center of face. These pulleys are supported on a 3 $\frac{1}{2}$ x 5-ft. shaft with bearings at 3 ft. 11 $\frac{1}{2}$ -in. centers. A 60 x 10-in. pulley on the head pulley shaft provides for driving the elevators without gear reduction.

The thickening and water-reclaiming system consists of the two classifier-overflow Dorr thickeners, the slime-tailing Dorr thickener, and the concentrate-water settling tanks. By consulting the water flow sheet, Fig. 3, it is seen that the pulp to the classifier-overflow thickeners in twenty-four hours is estimated at 180 metric tons of solids and 5,226 metric tons of water, and that a recovery of 4,506 tons of water will be obtained. If each tank takes half the pulp, the speed of rise in the tank of recovered water will be 55 cu.ft. per minute, which is equivalent to a velocity of about $\frac{1}{2}$ in. per minute, or, if all pulp goes to one tank, the velocity would be $\frac{1}{2}$ in. per minute, which is the maximum.

For the Dorr thickener handling the slime tailing, the pulp in twenty-four hours amounts to 168 tons of solids and 1,578 metric tons of water, of which 1,326 tons is recovered. The recovered water in this operation will have a speed of rise of 32.4 cu.ft. per minute, or a velocity of less than $\frac{1}{2}$ in. per minute.

All the thickeners are of redwood, with outside diameter of 50 ft. and staves of 10 ft. They are supported about 3 ft. from the ground on heavy timbers, to allow for drying and repairs. The mechanisms were furnished by the Dorr company and are driven by a 3-hp. motor with a speed of 1,200 r.p.m. A reduction is obtained sufficient to give the blades in the tank a speed of one revolution in about twelve minutes. The mechanism is supported over the tanks on trusses of 8 x 10's. The overflow from each set of thickeners is conducted to a 20-ft. diameter clear-water tank, from which the water is pumped back into the water system.

The duplex settling tanks for the concentrate are of

concrete, each about 4 ft. deep, 10 ft. wide, and 60 ft. long. At the overflow end the outside walls extend to make a tank 4 ft. x 4 ft. x 20 ft. 6 in. long. Adjacent to this is the pump house, in which are centrifugal pumps for returning the water to the water system. The pulp from the concentrate dewatering system is conducted to these settling tanks, first running into one and when that is full the laden water is turned into the other.

AMPLE PROVISION MADE FOR WATER AT CONSTANT PRESSURE

The water system need only be outlined. The water flow sheet shows that 6,929 metric tons have to be maintained in circulation for the twenty-four hours, and that 6,327 tons are reclaimed and 602 tons lost. Approximately all the water recovered comes from the classifier-overflow thickeners, the slime-tailing thickener, and the concentrate-water settling tanks. A large storage tank, built of rubble masonry, has been constructed on the hillside to keep the necessary amount of water in reserve at a proper pressure. Make-up water is supplied by the mine pumps. Two lines lead to the mill, and all mill pumps discharge into one or the other of these lines. All fire connections are directly on these lines. The mill supply water, however, is kept at a constant pressure by means of two separate pressure tanks placed in the highest part of the mill. They are connected to the supply lines and kept full by means of float valves. All the water for milling operations is drawn from these tanks, thus insuring ideal conditions for constant water feeds.

The mill building may be described as a wooden superstructure supported on a concrete substructure.

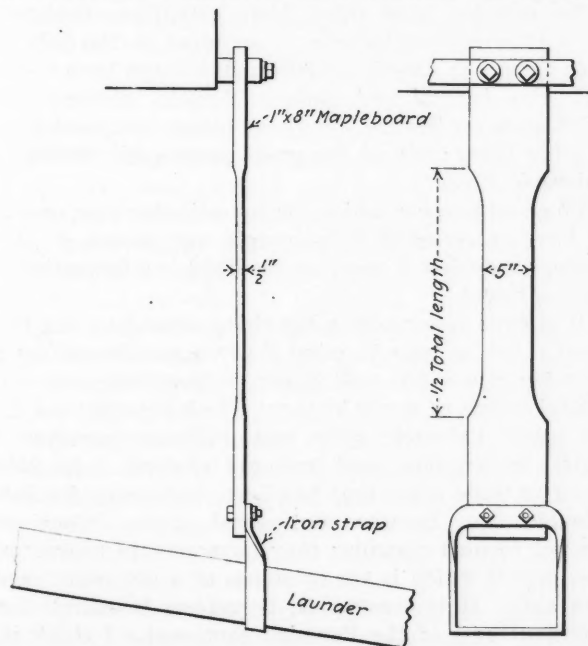


FIG. 10. METHOD OF SUPPORTING SHAKING LAUNDER

The table floor is of reinforced concrete, with slabs 5½ in. thick, reinforced both ways to take the load. The beams supporting these slabs are 12 x 18 in. Slab reinforcing is ½-in. and column reinforcing ¾-in. square bars. The columns supporting this floor are 12 in. square. The basement under the floor was so made as to provide for the requirements of the launders and drives. All floors on the ground are of concrete and slope ¾ in. to the foot, so that they may be self-drain-

ing. A tunnel through the center of the mill connecting the two elevator pits provides for the proper drainage of the entire mill.

The superstructure is supported on 10 x 10-in. columns or posts that are surmounted by 10 x 10-in. struts. The trusses over the table floor are of 10 x 10's and cover a span of 43 ft. 6 in. Corrugated galvanized iron is used to cover the building throughout. Rubber-glass sections were used instead of glazed windows.

Mountain of Sulphur in Pacific

Almost contemporaneously with the issue of the mandate of administration for the islands of Nauru and Ocean, famous for their extensive and rich deposits of phosphate of lime, was the rediscovery of the great sulphur mountain of Vanua Lava in the Banks group of the New Hebrides, according to an article in *Times Trade Supplement*. The special agent necessary to change phosphate rock to a soluble state is sulphur. Superphosphate is the powdered and soluble article sold to farmers as a fertilizer.

The mountain of Vanua Lava is one vast mass of sulphur. The height of the mountain, which forms an island in itself, is 1,600 ft., the area of the island being about 100 square miles.

Vanua Lava, as part of the Banks group, is included in the administration of the Condominium government of the New Hebrides. The Banks group lies between the fifteenth and the twentieth degrees of south latitude and is situated about 900 miles from the Queensland coast.

Twenty-five years ago a French company began operations on the mountain, employing competent engineers. The company built a long, substantial, coral-concrete wharf and a storehouse in a small bay at the foot of the mountain and constructed an aerial railway up the mountainside for nearly 900 ft. Hundreds of natives were employed in digging out the sulphur and hundreds more in carrying 50-lb. bags of sulphur to the railway terminus, whence carriers were sent rapidly to the storehouse on the bay. The first shipment of sulphur sent to France paid handsomely, but the company suddenly left the field, giving as a reason that malarial fever of a malignant type made it impossible for white men to live on the mountain island.

It was eventually stated, however, that the company had learned that the administration of the New Hebrides was not in a position to guarantee the company a monopoly, a prior right from an Australian engineer, the original discoverer of the commercial possibilities of the island, being in existence. Today this claim holds good, but Condominium law prevents any prompt commercial activities on the island. A British-Australian company is now endeavoring to begin operations, and has opened up negotiations with the Condominium government.

Maine Molybdenum Tested

A study of the problem of milling Maine molybdenum has been completed at the Mississippi Valley Station of the U. S. Bureau of Mines. The "low-grade" ore was found to contain too little molybdenum to be of any commercial importance or worthy of further mill testing. Mill tests on the "high-grade" ore, analyzing 1.1 per cent molybdenum, showed a recovery of 90 per cent of the molybdenum content; a concentrate being made which analyzed 85.8 per cent MoS.

The Permian Revolution in North America

An Extremely Important Geological Event Which Produced Immense Climatic, Geographic, and Geologic Changes in North America and the Study Of Which Gives a Wide Perspective on Ore Deposition in the Southwest

By J. R. FINLAY

Written for *Engineering and Mining Journal*

THAT THE FOLDING of the Appalachian range in the East occurred in Permian times is a commonplace of geological literature, but thus far I have found practically no reference to parallel events in the West. Of course it is well understood that an important change took place about that time all over the continent; but little prominence is given to the fact.

In the summer of 1919 I found fossils of Pennsylvanian age in Holcomb Valley, a part of the San Bernardino plateau of southern California, in a region of widespread metamorphism. No one apparently had dared to assume that the crystalline marbles and gneisses of the coast region were Paleozoic. Patches of marble and large areas of highly crystalline schist, invaded by granite and pegmatite, twisted and folded, looking in every respect like the traditional "Fundamental Complex," occur all along the coast from San Francisco southeastward through the San Bernardino and San Jacinto mountains for a known length of 500 miles. The discovery of Pennsylvania fossils showed at once that here was the localization of a post-Paleozoic dynamic event of the very first order.

SOUTHERN CALIFORNIA BATHOLITH FORMED IN THE PERMIAN

It is well known that the Sierra Nevada batholith, to the northward of this region, and seeming to merge or have some connection with it, emerged at the end of Jurassic times. It is a question whether the southern California batholith is an extension of the same occurrence; the final determination must be left to future, and probably extensive, investigation. All I am warranted in asserting with confidence is that the southern area of metamorphism originated between the close of the Pennsylvanian and the close of the Jurassic; but it is only reasonable to give the bases for the impression, which seems to have an increasing support of probability, that the principal mountain building and the eruption of the great southern California batholith occurred about Permian times, as a part of the world-wide revolution of that age; and that the Sierra Nevada batholith was a later and somewhat divergent one, perhaps a recrudescence of the same regional causes.

One strong reason for supposing that the southern California batholith and the resultant range was formed about Permian times is that some great continental land barrier is required, apparently, to explain the climatic changes of that period. Desert conditions prevailed during, or at the end of, the Permian, all the way from the Grand Canyon to eastern Kansas. This is proved by positive chemical, stratigraphic, and paleontological evidence. Not improbably evidence might be found over a much wider area; or such evidence may have been destroyed in other regions by erosion or covered up by later sedimentation. Still the evidence of desert conditions on so large an area that it may reasonably be called a good fraction of the continent is

undisputed and indisputable. Thus there is to be attributed to the later Permian a climatic situation very much like that of the present day. The corollary is that there must have been mountain barriers similar to those of the present.

ENORMOUS VOLUME OF WESTERN SEDIMENTS A GREAT FEATURE OF THE PALEOZOIC

But the mountain barriers of the Permian must have been formed by the upheaval of a tract that had remained undisturbed as a seat of sedimentation, pre-vaillingly marine, without any considerable outbreak of volcanic activity, without enough tilting of the strata or enough erosion to produce any noticeable unconformity in all the long ages of Paleozoic time. These barriers emerged through a field of sedimentation that is certainly one of the greatest on the continent, and one of the most persistent; for in it from 30,000 to 40,000 ft. of Paleozoic strata have been measured in various places by geologists. It was a continental marginal field that had been established firmly by the great world revolution that intervened between the Algonkian and Paleozoic cycles.

No one can give these facts attention—the patent facts of enormous volume of sediment in the belt running from Los Angeles northward through Inyo County, Cal., into central and eastern Nevada, western Utah, and thence northward,—without being convinced that it is a big thing: one of the great geographic features of Paleozoic times.

The land barrier, which the investigator may presume to have interrupted this trough, cut across it at an angle, producing a new, or modified, configuration for the continent.

Whatever supersedes a big thing must be a big thing itself. Let us bear in mind that we are discussing the Permian revolution, well known to have been one of the capital events of world history; which brought to a close the great Paleozoic cycle and produced immense climatic, geographic, and geologic changes. In North America wide areas that had been sea basins for interminable ages became continental areas. Continents are not formed casually; they have certain characteristics, one of which is the existence of a dominant mountain axis. It is reasonable, therefore, to search for a dominant axis of the Permian continent. I think it is found in southern California and that further investigation will prove it to be a major feature of the succeeding history of the western part of the continent, and perhaps will give further knowledge of both general and economic geology.

It is clear that extensive belts or zones of deposition, particularly of clastic sediments, must border on correspondingly great areas of erosion. Elevated regions, and especially mountain ridges, are the loci of many times more active erosion than low-lying plains.

An ancient pressure ridge or batholithic zone of the

first rank seldom contains magmatic orebodies of great economic importance. The crystalline core has generally been deeply eroded or even base-leveled. Ore deposits belong to a zone midway between the level of crystallization and the surface. The thorough metamorphism might be called a process of mineral integration and stabilization under great heat and pressure; ore deposition a process of mineral differentiation and segregation which is brought about by the escape and cooling of vapors or waters forced out by the crystallization that goes on below. If, therefore, erosion has reached the level of crystallization it will have swept away the zone of mineralization. Thus we should expect what we actually find—very little ore along the main axes, but a great deal along their extreme flanks and in outliers from them, in subsidiary batholithic intrusions.

It is germane to explain how this line of inquiry enters the field of economic geology. The best illustration is my own experience, although I have rarely claimed to be a geologist at all: it has enabled me to grasp the generalizations of the "magmatic" geologists. A steaming vent is one thing; its relation to earth movements, to the rock masses that it penetrates, to the formation of ore-deposits in extensive zones in which individual occurrences are apparently disconnected but really connected, is a much more important thing. I have found, for one instance, that the study of a nearly barren, or economically inconsiderable, area of batholithic intrusion like that of southern California (which I have called the Old Mohave Range) has been very enlightening by the comparison with important ore occurrences in other fields. For example, it enables me to find a logical economic starting point in Lindgren's generalizations on the ore deposits of New Mexico, where a group of intrusions of early Tertiary age follows a zone of mountain building through the whole length of the state; to perceive that geological processes have left this group in a very different stage than that of the metamorphic zone of the Permian; that only the superficial part has been exposed, and that it therefore contains possibilities for future discoveries which no longer exist in the deeply eroded parts of the older field.

Moreover, it is enlightening to perceive that the same influences have operated in the whole Cordilleran system, very likely from Alaska to Patagonia, making a practical tie between the ores of Butte and those of Leadville and Clifton, in that they are common offspring of the events which brought the Mesozoic era to a close, just as the events of Permian time brought the Paleozoic era to a close. Twenty years ago I took such statements with a grain of salt, relegating them to the vague theorizings of academic professors: "Ore in sight," "the estimation of ore deposits," "the cost of mining," were the practical things. I have been in situations where to mention a fault was to incur the suspicion of being a dangerous theorist—an impractical high-brow.

THE IMPORTANCE OF HAVING A PERSPECTIVE

Obviously, the scope of one's observations must run with the scope of one's activities. The mine foreman has little to do with the changes that go on in a continent; he is more interested in the changes shown by the round of holes. Within the sphere of a mine he is a better observer than a geologist, with longer and more anxious training. It is only when some phenomenon, foreign to his routine, invades his mine that he

must give place to someone of wider observation. If one's business is to get out pay ore, his geological interest is reasonably confined to the difference between the foot wall and the hanging wall; what part of a vein is pay and what not pay.

When one faces a larger economic problem—let us say, for instance, the consolidation of all the mines of a district for the purpose of working that district as a whole—he enters upon a different stage; the vein to which he has heretofore given exclusive attention is merely a sample; its peculiarities become trivialities; he begins to look for the signs, the limitations and the origin of *all* the veins. The crack in the rock which had been his economic field now becomes a mere crack in the rock; he is astounded at the multiplicity and variety of cracks; he sees that all deposits are not in cracks; he begins to look for a general cause. He finds it in a batholithic intrusion and is very glad to find it. That sort of talk no longer causes the suppression of snickers; it is practical.

There comes to many a man a still wider stage, in which one has to do with the resources of a state or of a nation. He now deals with the development of districts, just as before he dealt with that of deposits. He now brings into play a new mental element; the historical element; general tendencies, advance or decline. If he cannot meet the historical point of view in this field he must remain a tyro and a muddler. The historical point of view is the observation of tendencies and of averages, of progressive and cumulative change; it is the mainspring of the science of geology, of all the sciences that deal with evolution; it is essential to the economist, to the management of great business, just as it is to the scientist or statesman.

It seems that all lines of effort, however specialized, have a final meeting place in the field of human interest. One may assert positively that the economic geologist who pursues his subject successfully will reach a stage where he finds general geology more practical than specialized geology. It is easy to define that stage: it is where it becomes important to see the proportion of things.

Bureau Studying Lean Iron Ores

The work of the Bureau of Mines on iron ores is directed chiefly toward devising means for utilizing extensive deposits of low-grade ores than cannot be smelted profitably by present methods. The North Central mining experiment station of the Bureau of Mines, at Minneapolis, Minn., has continued to cooperate with the state mining experiment station in an investigation of the reserves of low-grade ore in the Lake Superior district, and in milling tests of samples collected in the course of the field work. This work has also included experimental tests of low-grade iron ores in the southern districts. With the establishment of the mining experiment station at Birmingham, Ala. more extensive work has been made possible, and a comprehensive survey of the iron and steel industry of the Birmingham district has begun. The main object sought is to develop means of beneficiating the low-grade highly siliceous ores that occur in large quantities in that district. At Minneapolis, the work has been more closely related to utilizing low-grade manganese iron ores of the Lake Superior district, particularly as regards the study of blast-furnace practice, and the operation of the experimental blast furnace at that station.

Mining Engineers of Note

Hugh F. Marriott

AMONG THE ENGINEERS who have played an important part in the development of technical practice at the gold mines on the Rand, in South Africa, Hugh F. Marriott occupies a prominent position, as the fact of his election to the presidency of the

Institution of Mining and Metallurgy in 1918 indicates. Mr. Marriott was born in London in 1869. He was educated at Bishop's Stortford Grammar School, famous for its association with Cecil Rhodes' early days. On leaving school he became a student at the Royal School of Mines, and following his graduation he went to Spain, where he worked in silver, lead, and copper mines. In 1891 he went to the Witwatersrand, South Africa, as assistant to Hennen Jennings. The Rand at this time was at the beginning of its fame, and Mr. Marriott was one of the first engineers to demonstrate the possibilities of deep-level mining. He brought out an invention for surveying boreholes by means of which it was found possible to ascertain the actual depths of reef deposits which previously had been considered to lie too deep for exploitation. During his fourteen years' stay in

South Africa, Mr. Marriott was connected with mining work in all parts of that country. In 1905 he came to London as consulting engineer to Wernher, Beit & Co., and now acts in a similar capacity to their successors, the Central Mining & Investment Corporation, of London. This corporation, in conjunction with Rand Mines, Ltd., is responsible for the general and technical administration of a group of mines on the Witwatersrand which last year crushed 24,000,000 tons of rock, or 47 per cent of the total for the whole gold field.

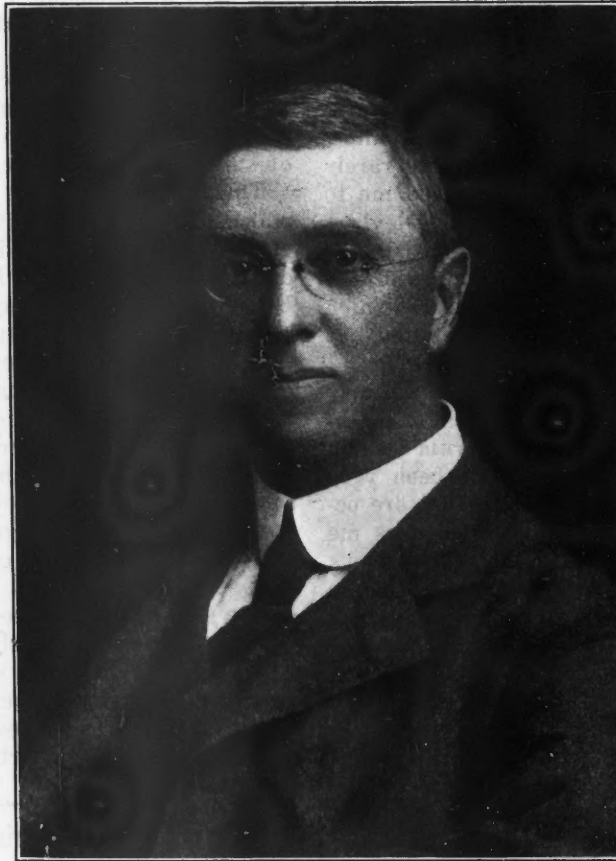
Owing to his intimate knowledge of South African conditions, Mr. Marriott has been able to introduce on the Rand many improvements in metallurgy, such as the use of Nissen stamps in crushing, and the employment of Butters filters for the treatment of slimes. He also was responsible for the adoption there of the principles of English colliery practice which have resulted in the sinking of shafts with greatly increased hoisting capacity and speed, and enabled the centralization of underground transport throughout the mines of the

Rand. In the evolution of shaft sinking, Mr. Marriott has always been a strong advocate of the circular shaft as superior to the rectangular type for deep-level mines. He has also made a persistent fight against the unsatisfactory system of calculating mine operation results on

the per-ton-milled basis. As a remedy he brought forward the fathomage system, which is generally employed there in underground work. Mr. Marriott has accomplished much pioneer work in the investigation of underground temperatures and ventilation conditions at depth. In 1908 he introduced sand-filling on the Rand, as the cheapest and most satisfactory means of supporting the ground above the worked-out areas. During his term of office as president of the Institution of Mining and Metallurgy he initiated the formation of overseas branches of the institution in all parts of the British Empire. In 1920 he was appointed a governor of the Imperial Mineral Resources Bureau, which had been incorporated by royal charter in 1919 for the purpose of furthering the exploitation of minerals and metals throughout the British

Empire. Mr. Marriott is also a fellow of the Geological Society of London and a member of the Institution of Civil Engineers, the Institution of Mining Engineers, the American Institution of Mining and Metallurgical Engineers, the Canadian Institute of Mining and Metallurgy, the Chemical and Metallurgical and Mining Society of South Africa, the Geological Society of South Africa, and the South African Institution of Engineers. Among his chief publications are "Borehole Surveying," "Deep Level Earth Temperatures," "Value of Rand Deposits," and "François Cementation Process."

During the Boer War Mr. Marriott attained the rank of captain in the Rand Rifles and raised the Rand Rifles Association to 500 members, a body noted for fine marksmanship. In the Great War he was appointed general manager of factories for the ministry of munitions in the Department of Explosives Supply, and held this post from May to November, 1915. He also commanded a company in the Old Boys' Corps which was organized in 1914 and did good service.



HUGH F. MARRIOTT

CONSULTATION

Preparation and Uses of Barytes

"I would like to know the various uses of barytes and how they influence the preparation of the material for the market. What is the general practice in the principal barytes fields in the production of a marketable product?"

Barytes, a natural barium sulphate, is one of the most useful of the non-metallic minerals. Its greatest application is in the manufacture of paint, either as a filler or a white pigment, as an inert base in colored pigments, or in the manufacture of lithopone, an intimate mixture of barium sulphate and zinc sulphide. There are many other uses of the mineral, as ground barytes and in chemical manufacture. Rubber goods may contain barytes as a filler, and it is employed in the manufacture of artificial ivory, oilcloth, paper, linoleum, and lithographic inks.

In the form of various barium chemicals it is highly important. Blanc fixe, a chemical product, is particularly useful, and although in chemical composition it is almost identical with ground barytes, its physical properties are different. Blanc fixe is the artificial barium sulphate, and is precipitated from a solution of a soluble barium salt, usually by means of salt cake. It is better for pigment purposes than ground barytes, and naturally commands a higher price. Other barium chemicals are used in the manufacture of optical glass and in the ceramic industry.

Although chemical purity is essential in the best grades of barytes, physical properties are important and influence its value. A white color is desirable, the whiter material commanding the highest prices. Uniformity in the screen size of the finished product is also important. Frequently, an inferior looking barytes through proper treatment may be transformed into a good grade.

The Southern and the Western are the two most important barytes fields in the United States. The Southern field lies in the states of Georgia, Tennessee, North and South Carolina, Alabama, and in general throughout the Southern States, whereas the Western barytes comes mainly from the State of Missouri. Missouri and Georgia are by far the two most important producing states, together in 1920 accounting for 85 per cent of the domestic production of 228,100 tons. The mines in both these fields are operated on a different system, the Missouri producers leaning toward smaller operations and depending upon hand work, whereas the Georgia operations, which are larger, use steam shovels. In part this is due to the different character of the ore that is usually found in both districts.

Barytes may occur as a hard crystalline mineral or as a soft material. The hard mineral has a characteristic glassy appearance, whereas the friable variety appears milky. The soft type is preferred by grinders, and is the mineral variety generally found in the Missouri mines. The Georgia deposits are of the hard crystalline nature. Tennessee is reported to contain deposits of both types.

Many small mines are responsible for the output of domestic barytes, open-pit operations being the rule. The Southern mines have been developed to a greater extent than those in the Middle West. After mining, either by hand or steam shovel, the ore, which may run between 25 and 30 per cent barytes, is taken to a washer, where it is crushed and log washers or other suitable devices are used to remove the clay and earthy impurities adhering to the mineral. It is then screened, the oversize going to a picking belt and the undersize to a jig. If the product is to be sold as ground barytes, a tube mill may be used to grind it, followed by water flotation. In grinding barytes it is well to use a medium that will not discolor the mineral.

Barytes, being an exceptionally heavy mineral, is easy to concentrate, and can readily be separated from impurities such as quartz and clay. If the ore when ground is found to be stained yellow owing to the presence of iron, it may be bleached with sulphuric acid or sold as an "off-color" product, in which event it would probably be used for dark-colored paints or other uses in which a white pigment is not essential. When bleached and floated it is known as a "prime white" material.

Keeping Qualities of Permissible Explosives

"Will you kindly tell me how long the mining powders may be expected to retain their qualities without marked deterioration under high temperatures (100 to 110 deg. F.) and low humidities? Under high temperatures (100 to 110 deg. F.) and high humidities?"

"What effect has low temperature on the keeping qualities of mining powders? Ordinary temperatures?"

Under the high temperature range indicated, 100 to 110 deg. F, and low humidities, the mining powders may be expected to retain their qualities for one or two years, but under the same temperature conditions and high humidities this period is cut down to only a few months, according to one large manufacturer of explosives.

Low temperatures have no effect on the keeping qualities of mining powders, provided the temperature is above the point at which the powder freezes. Once frozen, then thawed, the powder freezes much more quickly than the first time. There is no other appreciable effect on the properties of the powder.

At ordinary temperatures, 60 to 80 deg. F., and ordinary humidities, mining powders may be depended upon to keep their strength for one and one-half to two years.

Water-Cooled Pipes for Blowing Copper

An inquiry was published in *Engineering and Mining Journal* of Nov. 5 regarding the possibility of using water-cooled pipes for blowing copper. If the interested parties will look up U. S. Patent No. 1,352,912, issued Sept. 14, 1920, I am confident they will find a solution to their troubles.

ALLEN R. PARTRIDGE.

Cleveland, Ohio.

HANDY KNOWLEDGE

Neighborly Chats With the Foreman Handling Men

BY DUNCAN MACGREGOR

Written for *Engineering and Mining Journal*

Remember, Jim, you were once a workman yourself. You had to take orders from shift bosses and foremen for quite a time, as I remember. This last trouble you have brought to me leads me to believe that you have forgotten that fact. In a way the mine is your client, and a considerable part of the superintendent's responsibility is also yours. You can't overlook either of these facts, but if you would junk your likes, dislikes, and prejudices, and think sometimes from the angle of the men you are looking after, you would be a little more careful about breaking loose the way you did. Keeping control of yourself is one of the big factors in keeping control of your men. Just when you feel yourself going up in the air, throw your foot on the clutch and put on the brakes and say, "We'll talk about that tomorrow."

One of the handiest ways to get at a man is to ask him, "What do you think about it?" or, "How would you do it?" It's a good plan to get your men to think along the lines you have to. Perhaps you will not be altogether pleased with the scheme he suggests, and then you can ask him: "What do you think of this plan?" It's a safe bet that he will fall for your plan or point out some weakness you have overlooked.

Of course, quick decisions are often necessary. If you have to handle a fire, a cave, or an accident, you can't take time to ask questions, but there are other times when you can stir up a little interest by showing some interest in your men. When you want to fire a man, think it over for a spell. Try him in several different jobs before you are definitely through with him, if you can see anything of value in him.

Your men and yourself are in a common cause to make the mine pay and to prevent accidents. Your principal hold will depend largely how honestly and systematically you deal with your men on a man-to-man basis.

A Coarse Ore Transfer

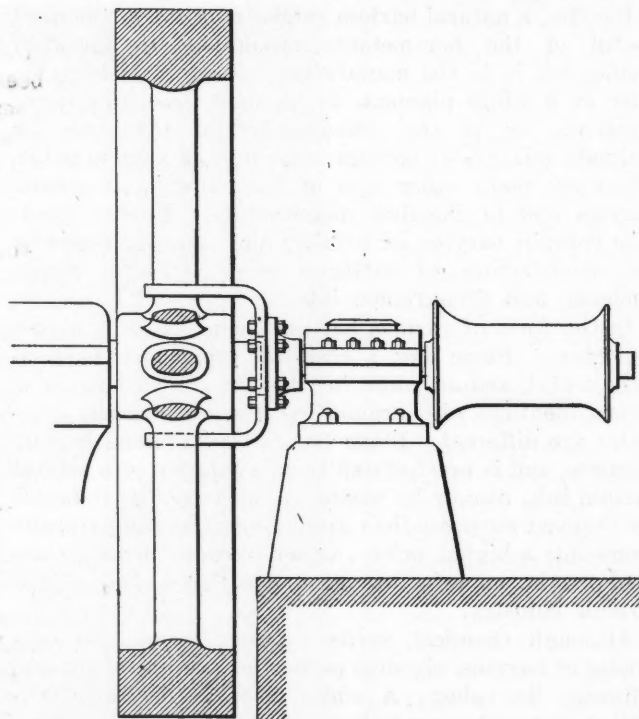
BY JAMES T. KEMP

Written for *Engineering and Mining Journal*

The transportation of material in mixed sizes from place to place is one of the ever-present problems of the smelter man. Small tonnages and fine stuff offer fewer difficulties than coarse materials in moderate tonnages. A great variety of inexpensive conveying apparatus is available for handling lumps up to 10 or 15 lb. weight. Large tonnages of coarse materials necessarily require heavy equipment. There are often operations in which the size of the material would require heavy machinery, but the tonnage does not warrant its installation. One such problem and its satisfactory solution is here described.

Ore was to be gathered from an 80 x 40-ft. sorting

floor in one building, weighed, and carried about 150 ft. across a railroad track at grade to a crusher in another building. Single chunks weighing as much as 1,000 lb. had to be handled frequently. The movement of ore was irregular, occasionally reaching 50 tons a shift. The size of the larger pieces precluded the use of a



WINCH HEAD OPERATED BY FLYWHEEL BY MEANS OF TWO-PRONGED SPIDER

conveyor; therefore a narrow-gage railroad was selected. It was built from the side of the sorting floor to the crusher and elevated at the end so that a car would dump directly into the crusher. The scale was placed in a lean-to outside the sorting floor. A V-bottom dump car with a removable body was adopted. Three bodies were provided, to allow loading at several places simultaneously.

The crane in the main building served the sorting floor and was used to pick up the dump-car bodies, to place them conveniently on the floor for loading, and to replace them on the car truck as they were filled. The crane was also used to pick up all pieces of ore too large for a man to lift. Loaded cars carried two tons. They were pulled to the crusher by a $\frac{3}{4}$ -in. hemp rope run through a snatch block to a winch head driven from the crusher shaft. The empty car was easily pushed back by one man. As the rope was hooked to an eye in the end of the car frame, it could be quickly detached and pulled clear of the main yard track to permit a train to pass. The yard tracks were only notched for the flanges of the dump-car wheels.

The winch head was taken from a discarded hoisting engine. It was keyed on a short piece of shafting and overhung a heavy bearing which was mounted solidly on a concrete pedestal. One-half of a shaft coupling

was keyed to the end of the shaft facing the crusher flywheel hub and carried a two-pronged spider cut from 1-in. plate. The spider was bent U-shaped so that the prongs projected between the spokes of the flywheel. A heavy guard of pipe and woven wire was built around the flywheel to prevent the operator or the rope from getting caught.

This haulage system proved entirely satisfactory. No difficulty was experienced with the loose hemp rope. The installation was compact and inexpensive to install. One man attended the crusher, moved the car back and fourth, and did the weighing without assistance.

Grain vs. Flesh Side for Leather Belts

The question of whether a leather belt should be run with the grain or flesh side next to the pulley has been much debated. It has seemed to some that a closer contact with the pulley could be had by putting the grain side of the belt next to it. Others have contended with equal conviction that the flesh side, being tougher, was better able to withstand friction.

During the last summer, tests of the capacity of the grain and flesh sides of leather belts were begun by the Leather Belting Exchange in its research laboratory at Cornell University. They were under the direction of R. F. Jones, director of the laboratory. Covering a period of more than two months, continuous tests were run on the testing apparatus belonging to the Exchange, which is being operated under the supervision of Cornell University, using five 4-in. single belts, 30 ft. long, of different manufacture. They weighed from 16 to 18 oz. Every effort was made throughout the tests to standardize conditions and to reduce the probable error to a minimum, and this unquestionably was accomplished. All five belts were run long enough previous to the experiments to have been thoroughly "run-in," and had reached a condition of constant capacity when the records were taken.

The method of procedure was to take horsepower readings from the belts first when running on the grain side, and then when running on the flesh, the power being gradually increased until about 4 per cent slip had been reached.

In considering the results, it must be remembered that a leather belt is at its lowest point of capacity when new, largely because of the elasticity of the leather and the newness of its surface. Leather belts are well stretched in the process of manufacture, so that when the belt is put on the pulley there may be as little stretch as possible consistent with thorough lubrication and retaining the natural life or elasticity, which is such a valuable property of the leather belt. When a new leather belt is placed on the pulleys, however tightly, it will elongate under load; but after the tension of the load has been removed it returns very nearly to its original length. This stretch is an annoyance when installing a new belt, but it is of the nature of a safety valve, protecting both belt and machinery.

The newness of the surface, however, makes it necessary to "run in" the belt when testing it. That is, to run it for a sufficient time to permit the belt to attain its maximum capacity in transmission. As an illustration, one belt under test at the Cornell laboratory transmitted 12 hp. when first put on the pulley at a slip of 1.2 per cent. After five hours' running it reached 19 hp. with the same percentage of slip and the same tension. At the end of thirteen hours it transmitted

24 hp., and reached 31 hp. after twenty hours with a slip of 1.6 per cent. According to horsepower tables, its scheduled transmission should have been 26 hp.

Inasmuch as the belts used in the tests seemed to be typical, and the apparatus at hand was such as to give the most accurate readings of performance, the results should be scientifically acceptable.

A summary of all of the results is clearly in favor of the grain side from the standpoint of power transmission. In fact, it may be concluded from it that under reasonable shop tension, the flesh side will average only 50 to 60 per cent as much horsepower as the grain side. At higher tensions the flesh side will do better, averaging from 50 to 100 per cent as much power as the grain, depending upon the belt, the tension, and the conditions of service.

A curve plotted from the readings taken when the belts were running on the flesh side is similar both in shape and capacity to that given by many of the leather belt substitutes. All that can be said of the test belts run on the flesh side is that the data obtained from them were more uniform than when running on the grain.

The grain tests showed an almost curveless gain in horsepower up to 53 hp. transmitted, when the slip reached about 3 per cent for belts running at a slow running tension of 432 lb. In the case of the test belts operated at a slow running tension of 288 lb., the 3 per cent slippage was reached at about 44 hp. With the belts running on the flesh side, however, the 3 per cent slippage mark was reached at 28 hp. when operated at a slow running tension of 432 lb., and at 16 hp. when the tension was 288 lb.

Safety Device for Station Gate

By ROY H. POSTON

Written for *Engineering and Mining Journal*

Mine station gates are often left open when the cage is in motion. To obviate this possibility the wiring of the signal bell at one shaft is so arranged as to make it necessary for the station gate to be securely closed before a signal can be given to the engineer.

Part of the electric circuit is attached to the gate and part to the shaft timber. Contact is made through contact plates and contact fingers, the latter being simply discarded contact fingers from an electric controller, and the former small copper plates. A snug-fitting latch is placed on the gate to hold it securely.

Examining Minerals in Ore Pulp

By ALFRED T. FRY

Written for *Engineering and Mining Journal*

To examine a sample of wet pulp under a microscope use a clean slide not greased. Drop a small patch of sample upon it, apply a piece of blotting or filter paper to the edge to absorb superfluous moisture, then turn the slide glass-side up, and examine with the microscope. It is advisable to exercise care in shaking the slide before mopping up the water, as it may result in concentrating mineral next to the glass.

It is often preferable to remove slime from a sample by gentle washing or elutriation before examination, as, with a low-power instrument, slime particles are not easily recognizable and interfere with the visibility of larger grains. (See *Engineering and Mining Journal*, Dec. 24, 1921, p. 1022.)

THE PETROLEUM INDUSTRY

California Production for November Shows Increase

Daily average production of petroleum in the United States increased 110,268 bbl. during November, as compared with October, according to the U. S. Geological Survey. The greatest increases were in California, owing to the termination of the strike in the oil fields, and in Texas as a result of developments in the Mexia field. Gains in daily average production are also recorded for Wyoming, Oklahoma, Kentucky, Pennsylvania, Ohio, Tennessee, and Colorado. Decreased daily average production is reported for Kansas, Louisiana, Arkansas, Illinois, Montana, West Virginia, New York and Indiana.

The number of producing oil wells completed during the month increased 151 over the number completed in October, and amounted to 903.

Daily average imports of petroleum increased 59,725 bbl., and 12,993,763 bbl. were imported during November. Daily average exports of crude oil increased by 4,722 bbl.

Estimated daily average consumption during November was 1,550,367 bbl., a gain of 92,173 bbl. during the month.

The California oil production for November of 8,808,468 bbl., which averaged 293,616 bbl. per day, shows an increase of 65,751 bbl. over the October daily production of 227,865 bbl., according to the Independent Oil Producers Agency. The daily production for the current month is 17,118 bbl. less than the November, 1920, production.

Shipments during the month averaged 296,443 bbl. daily, 15,425 bbl. less than the daily shipments during November, 1920, and 6,754 bbl. less than the November, 1919, shipments.

Stocks were reduced 84,819 bbl. during November, leaving a surplus for the year to date 10,327,405 bbl. Stocks on hand Dec. 1 amounted to 29,946,251 bbl., 9,994,413 bbl. greater than the Dec. 1, 1920 storage.

Seventy-five rigs were erected, 519 wells active drilling and 15 holes abandoned during the month. Fifty wells were completed with an initial daily production of approximately 12,000 bbl., and 9,240 wells were producing during the month.

A Diamond-Drilled Oil Well

SPECIAL CORRESPONDENCE

The first producing oil well ever brought in, in any field, by means of a diamond core drill was recently completed in the Tampico district. This is well No. 6 on the Panuco Boston property, and was brought in at a depth of 2,153 ft. and is flowing 1,200 bbl. per day. The hole is 3½ in. in diameter at that point. It was standpiped and chopped down to 1,400 ft. with a "fishtail" bit and 4-in. casing, through the overburden and soft material. From 1,400 to 2,153 ft. a diamond bit was employed, and a high percentage of core recovered, giving the geologist accurate information as to the thickness and character of the oil sands.

Recent Completions in Mexia Field

SPECIAL CORRESPONDENCE

The Prairie Pipe Line Co. is building an 8-in. pipe line from Mexia to Hensley station, in Jack County, Tex., a distance of 150 miles. Four pumping stations will be built, one each at Mertens, Weatherford, Cleburne, and Mexia. The Sinclair interests have contracted with the Chicago Bridge & Iron Works for fifty 80,000-bbl. tanks. These are to be placed in one tank farm for Mexia crude-oil storage.

Recent completions of interest in the Mexia field include the Humphreys-Mexia No. 1 Berthelson well, flowing 100 bbl. pinched in from 3,115 ft.; the same company's No. 1 Mills, flowing 2,000 bbl. from 3,105 ft.; Magnolia Petroleum Co.'s No. 1 Mills, 10,000 bbl. from 3,050 ft.; and Woodbine Oil Co.'s No. 1 Slaughter, 15,000 bbl. from 3,025 ft.

North of the Mexia field near Currie, the Meador well of the Mex-Tex Oil Co. recently began flowing 400 bbl. of 42 deg Bé. oil. This is believed to be on a separate structure from the Mexia field.

Spokane Oil Bubble Broken

SPECIAL CORRESPONDENCE

Another chapter in the recent Spokane oil boom was closed on Dec. 19, when Mr. and Mrs. A. L'Ecuyer, local residents and owners of property in a residential section of the city, where an oil seep was discovered last spring, were acquitted in the Federal court of a charge of using the United States mail with intent to defraud. The claim was advanced that the spring had been "salted," and L'Ecuyer, as president of the Eastern Washington Oil Co., had made use of the mails in furthering sale of stock in his company. Evidence presented by the Government officials in the shape of testimony of chemists, showed oil from the spring to be 40 per cent kerosene and the balance a saponifiable oil, very much like cottonseed oil.

Oil-Well Machinery Exports Decrease

The value of oil-well machinery exported in November is reported by the Department of Commerce to be \$320,828. This is a little less than half the value of the exports of oil-well machinery in November of 1920. The value of all other mining machinery exported during November was \$324,775. A year ago exports under this latter item were valued at \$654,277. The exports of pumps and pumping machinery during November were valued at \$343,629. This is about one-fourth of the value of pumps exported in November of 1920.

Red River Boundary Settled

SPECIAL CORRESPONDENCE

The latest development in the Texas-Oklahoma dispute over the Red River boundary, involving oil lands of value, is a contention set up by the Government in a brief before the Supreme Court, filed on Dec. 2, that the owner of the Red River bed is the United States.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Separation Problems Under Study by Bureau of Mines

Plans have been formulated by the U. S. Bureau of Mines for a complete survey of the milling problems of the tri-State district of Missouri, Oklahoma, and Kansas, with the object of improving the recovery of zinc in the mills. Other problems that may be considered are the recovery of zinc from tailings, determining the amount of sphalerite made excessively fine by the blasting, and removing lead from the "flotation zinc." This work is being conducted in co-operation with the Missouri School of Mines and Metallurgy.

It has been brought to the attention of the Bureau that zinc has been encountered in increasing amounts in the fluorspar ores of southern Illinois and Kentucky. The ordinary treatment by jig and table concentration results in a considerable loss of fluorspar, and zinc cannot be removed by this method, because the zinc and the fluorspar differ so little in specific gravity. Experiments at the station resulted in developing two improved methods. One, employing electrostatic separation, takes out the lead, gives a marketable zinc concentrate and also a spar product of practically any grade desired—99 per cent calcium fluoride having been made in the tests. This fact makes possible the production of acid spar (98 per cent CaF_2) from the gravel spar (85 per cent CaF_2) now produced. Acid spar commands a much higher price than gravel spar. The second method employs flotation. Tests gave a higher recovery of zinc than was obtained by electrostatic separation, but the spar product is lower grade and finer grinding is necessary. The method, however, is a great improvement over earlier methods, and as compared to electrostatic treatment is preferable in stormy weather. A large company, whose representatives assisted in the tests, has adopted it for treating this type of ore.

Plans were formulated for an investigation by the Bureau of Mines of proposed methods for the electrothermic metallurgy of zinc, and their possible application in the United States, with a view to increasing the recovery of metal and lowering the cost of production, which, with the standard retort process, is so high that it endangers the position of zinc as a cheap metal.

The processes so far proposed may be divided into two types: (1) Electrothermic dry distillation, which may be conducted in large units, but follows closely the metallurgical principles of the retort process in chemical and physical reactions; (2) electrothermic smelting, in which the ore is fed con-

tinuously into the furnace, the zinc vaporized, and the residue smelted to liquid products which are drawn off. The Survey research investigations will include both types.

There is a lack of fundamental data for working out new metallurgical methods for zinc. Such data will have value in the electrothermic metallurgy of zinc and also in the retort process. Study is being made by the Bureau of Mines of the physics and chemistry of the reduction of oxidized-zinc compounds, the condensation of zinc vapor, and behavior of the metals commonly associated with zinc—such as cadmium, lead, and silver—during distillation and condensation. The electrothermic metallurgy of zinc also offers possibilities in the treatment of complex ores of zinc, lead, copper and silver.

The Mississippi Valley Experiment Station devised a method for treating certain residual concentrate from zinc retorts. This concentrate is not amenable to ordinary retort distillation, which results in a low recovery of zinc and a rapid destruction of retorts. Briquetting the material before distillation resulted in 97 per cent extraction; retort destruction is practically nil and larger charges can be handled. This work is to be continued on a large scale at Fort Smith, Ark.

Loss of fines in the tailings of zinc mills in the Wisconsin district has long been a vexing problem. Since 1911 some of the mining companies have made an earnest effort to utilize the fines, but without satisfactory results. In January, 1921, at the request of the operators, the Bureau of Mines took up this problem. Examination showed that the minus 20-mesh material is the one most amenable to profitable re-treatment. The evidence so far gained is that by screening the tailings on a 20-mesh screen, 65 per cent of the zinc content will be concentrated in the fines, and the fines will amount to 25 per cent of the whole; that is, the ratio of concentration will be 4 to 1, and the recovery 65 per cent. Laboratory tests indicate that concentrating tables placed in the mills to treat the fines will recover 90 per cent of the zinc content in a low-grade concentrate assaying about 20 per cent zinc, and that this concentrate can be graded up to 62 per cent zinc in central plants where flotation and gravity concentration are combined. It is estimated that this practice would have added about \$1,000,000 annually to the value of the zinc output had it been in operation in 1917. Two by-products, marcasite and ground limestone, would have been available for sulphuric acid and for agricultural purposes, respectively, according to the results of the tests.

Treatment of Mixed Copper Ores Discussed

The San Francisco Section of the American Institute of Mining and Metallurgical Engineers held a meeting at the Engineers' Club Dec. 27, following a dinner. H. W. Morse spoke on "The Present Status of the Treatment of Mixed Copper Ores." Mr. Morse has been connected with some of the larger recent installations in Arizona and the subject was of great interest to those attending.

Fires Discussed at Utah Meeting

At the December meeting of the Utah Society of Engineers held at the Salt Lake City Commercial Club, the speakers were W. H. Lovesy, traffic manager of the Utah Oil Refining Co., whose subject was, "Oil Plant Fires," and A. C. Watts, chief engineer of the Utah Fuel Co., who spoke on "Coal Mine Fires."

Toronto Meeting of American Association for the Advancement of Science

Engineers, publicists and educators addressed Section M. of the American Association for the Advancement of Science, which met in Toronto Dec. 27 to 30, inclusive. According to the program recently published by the Federated American Engineering Societies, Sir Clifford Sifton, K. C. M. G., formerly Minister of the Interior, and head of the Conservation Commission of the Dominion of Canada, will open the sessions on Tuesday with an address on "Views on the Development of the Natural Resources of Canada."

Wednesday's speakers, morning session, will include: J. E. Hardman, Montreal, "Fifty Years of Progress in Mining in Canada."

Speakers at the afternoon session on Wednesday will be: Thomas W. Gibson, Deputy Minister of Mines, Ontario, "Recent Progress in Metal Mining in Ontario;" A. F. Brigham, general manager, the Hollinger Mine, Ontario, "Gold Mining in Ontario;" W. L. Dethloff, chief engineer, The Mond Nickel Co., Ontario, "Nickel Mining and Smelting."

"Toronto Harbor Development" will be discussed at Thursday's sessions by E. L. Cousins, chief engineer and manager of the Toronto Harbor Commission. Other speakers will be: R. A. Ross, chairman, Honorary Advisory Council for Scientific and Industrial Research, Canada, "Industrial Research;" H. K. Wicksteed, formerly chief locating engineer, Canadian Northern Railway, "Railway Development in Canada;" A. M. McQueen, vice-president, the Imperial Oil Co., Toronto, "Exploration for Oil in Western

Canada"; James McEvoy, Toronto, "Coal Mining in Alberta;" D. B. Dowling, Geological Survey of Canada, "Oil Resources of the Valley of the Mackenzie River;" Sir Adam Beck, chairman, Hydro-Electric Power Commission of Ontario, "Hydro-electric Development in Ontario."

Geological Survey's Work in Utah

The Salt Lake City offices of the U. S. Geological Survey are in need of a local geological attaché, according to the annual report received by V. C. Heikes, statistician of the survey at Salt Lake City. The appointment of a geologist in such a position would be a help toward meeting numerous demands for information received regarding non-metallic minerals, especially oils, and would make it possible to handle the work in connection with the various industries with more dispatch. During the fiscal year ended June 30, 1920, profile surveys were made by the survey of a number of streams in the Utah Lake Basin, in Summit, Wasatch, Morgan, Utah, and Juab counties. Also there was done 124 sq. miles of mapping of territory in the state and of 283 sq. miles of river traverse for the land classification board. Reports and professional papers compiled in Utah during the year were: "Report on the Mining Geology of the Cottonwood District," by B. S. Butler; "Report on Manganese Deposits of Utah," J. T. Pardee; "General Reconnaissance of Local Structures in Kane and Garfield Counties; Description of Paleozoic Sections in Southwestern Utah," J. B. Reeside, Jr., and Harvey Bassler; "Phases of the Carboniferous and Triassic of Southern Utah," J. B. Reeside, Jr.; "Stratigraphy and Petroleum Resources of Washington County," Reeside and Bassler; "Paleozoic Fossils of Utah," G. T. Girty; "Cretaceous Invertebrates," T. W. Stanton; and a report on the coal resources of the Wasatch plateau by a party headed by E. M. Spiker.

Other work for the year included the mapping of a part of Book Cliffs and Huntington Canon regions; investigation of the geology in connection with the Colorado and San Juan River damsites at Green River; Lee's Ferry and Bluffs by H. D. Miser, Kirk Bryan, and C. R. Langwell; a report on oil-impregnated sandstones in the lower part of the Green River formation east of Jensen, by David White and K. C. Heald, and a report on oil shales of the Rocky Mountain region by D. E. Winchester.

MEN YOU SHOULD KNOW ABOUT

A. R. Baldwin has been appointed general manager of the Utah Fuel Co., to succeed Alexander H. Cowie.

Walter R. Vedler is engaged in petroleum engineering and production in northwest Texas and Oklahoma fields.

S. F. Shaw is examining mines in Santa Barbara, Sombretete, San Luis Potasi, Monterey, and Sierra Mojada, Mexico.

James P. Porteus of the Bonney mine, Lordsburg, N. M., is visiting Los Angeles and San Francisco on mining business.

J. A. McDougall, master mechanic for the Phelps Dodge Corporation at Tyrone, N. M., has been transferred to Bisbee, Ariz.

W. G. Mather, president of the Cleveland-Cliffs Iron Co., has concluded a visit to the properties of the company on the Marquette Range.

Frank M. Smith, of Spokane, smelter director of Bunker Hill Mining & Concentrating Co., is spending the Christmas holidays at his old home in the East.

W. L. Zeigler, mill designer, Spokane, was recently injured in an automobile accident near Coeur d'Alene City, Idaho. At the time of the accident, Mr. Zeigler was on his way to Coeur d'Alene City, where he was one of the technical witnesses for the plaintiffs in the Star-Federal accounting case.

Sir John Cadman, formerly the British Petroleum Director, was entertained recently at luncheon at the Cosmos Club in Washington by George Otis Smith, director of the U. S. Geological Survey. There were present to meet Sir John, First Assistant Secretary E. C. Finney, and Assistant Secretary F. M. Goodwin, of the Department of the Interior, Director H. F. Bain, E. A. Holbrook, and A. W. Ambrose of the Bureau of Mines, David White, Philip S. Smith, A. H. Brooks, W. C. Mendenhall and K. C. Heald, of the U. S. Geological Survey.

Clarence E. Allen will retire on Jan. 1 as general manager of the intermountain department of the United States Smelting Refining and Mining Co. Mr. Allen is succeeded by Downy Davidson Muir, Jr., who has been manager of mines, stationed at Salt Lake City. Mr. Allen has been connected with the United States Co. for many years, coming to Utah forty years ago. In his earlier association with the company, Mr. Allen was in charge of the Centennial Eureka mine in the Tintic district, later becoming manager of mines. Mr. Allen has been a public-spirited citizen, and was for several terms a member of the territorial assembly before the days of Utah's statehood. In 1895 he was elected United States Congressman.

The Utah chapter of the American Mining Congress, following the notice of Mr. Allen's coming retirement from active work, has elected him an honorary member for life of the organization. He is a charter member of the chapter and has advanced the affairs of the organization as one of the local directors from the beginning, and he is the first member to be honored in this way.

Mining and metallurgical engineers visiting New York City last week included: Elmer Bird, Little Rock, Ark.; J. T. Smoody, Uniontown, Pa.; R. G. Knickerbocker, Rolla, Mo.; W. E. Hopper, Shreveport, La.; Walter H. Hill, Stanley, Idaho; F. G. Lasier, Detroit, Mich.

SOCIETY MEETINGS ANNOUNCED

The next annual meeting of the British Columbia Division of the Canadian Institute of Mining and Metallurgy will be held at Vancouver during the first week of February, 1922.

The next annual convention of the American Association of Engineers will be held in Salt Lake City June 5, 6, and 7, 1922. C. J. Ullrich has been appointed chairman of the convention committee in Salt Lake City. Other members of the local committee are C. E. Painter and H. A. Harmon.

The College of Mines, University of Washington, will hold its twenty-sixth Annual Winter Mining Session during the twelve weeks from Jan. 5 to March 22. This session is open to any interested man who can read and write English. The expenses will be limited to a tuition fee of \$15, laboratory deposits to cover materials actually used and the cost of the necessary textbooks. The training consists of lectures with laboratory practice, for which the laboratories of the College of Mines are thoroughly equipped.

OBITUARY

Tingley S. Wood, mining engineer of Denver, died suddenly on Dec. 11. He was seventy-five years old.

Donald G. Campbell, a member of the firm of Campbell, Wells and Elmen-dorf, of Seattle, was drowned Dec. 18. Mr. Campbell graduated from the Columbia School of Mines in 1914.

C. L. Van Derlip, metallurgist with the American Smelting & Refining Co., died at Monterey, Mexico, on Nov. 30. Mr. Van Derlip was twenty-nine years old, and was a graduate of the University of Kansas.

John C. Pennie, senior member of Pennie, Davis, Marvin & Edmonds, patent attorneys, died on Dec. 23. Mr. Pennie was born at Albany, N. Y., in 1858. He graduated from Union College in 1877, later studied in Gottingen and Heidelberg, and in 1880 entered the Patent Office as examiner. In 1883 he commenced the practice of patent law in Washington and New York. Mr. Pennie acted as patent attorney for most of the large mining companies.

THE MINING NEWS

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Leading Events

Full details of the proposal to purchase control of the American Brass Co. have been put before the stockholders of the Anaconda Copper Mining Co. in a circular issued by the company. Earlier reports are verified. It is rumored in Butte that Anaconda is to resume at an early date.

Secretary of Commerce Hoover has been appointed Federal chairman of the Colorado River Power Commission.

The New York State Board of Engineer Examiners,

following its recent meeting at Albany, has issued its first licenses to engineers to practice in the state.

A petition to sell the property of the Consolidated Arizona Smelting Co. has been made by the receiver.

Custom shippers in British Columbia have been informed that the Trail smelter will settle for ore hereafter on a cash basis instead of at ninety days.

Operations of the Colorado Fuel & Iron Co. at the Pueblo steel mills are to be increased early in 1922. The ore and coal mines of the company will be affected.

Consolidated Arizona Receiver Seeks To Sell Property

Southwest Metals Co. Hopes To Buy In. Holdings With Proceeds of Bond Issue

A petition by the receiver for an order to sell the property of the Consolidated Arizona Smelting Co. is now before the United States court at Tucson, Ariz. The hearing has been continued until Jan. 16. The Southwest Metals Co., which is undertaking to reorganize the smelting corporation, has required actual ownership of about 98 per cent of the unsecured claims and of about \$650,000 of the first mortgage bonds, leaving about \$300,000 of the bonds as yet not acquired, but under option. It is reported to have under option also practically all the lien claims. The Southwest Metals Co. is now offering a bond issue of \$600,000 for subscription, to be secured by first mortgage on the properties of the Consolidated Arizona Smelting Co., when the same shall have been acquired by the Southwest Metals, which expects to become the purchaser of the property at receiver's sale. From a representative of the company it is learned that should the Southwest Metals Co. be successful in floating the bond issue it will be able to become the purchaser of the property for the amount of the claims against the Consolidated Arizona Smelting Co. and will be provided with a sufficient capital to operate the property when conditions of the copper market will justify operation.

Anaconda To Resume Soon?

The Anaconda Copper Mining Co. is reported to be making preparations to resume at a very early date which, it is said, has been fixed. The announcement is being held until wage schedules are decided upon by the company, according to such information as can be had.

Trail Smelter To Settle on Cash Basis

Circulars have been sent out by the Consolidated Mining & Smelting Co. of Canada, Ltd., notifying custom ore shippers of a change in method of payment for ores, effective Jan. 1. The new basis of settlement provides for practically a cash settlement for ore, instead of the ninety-day settlement in effect for some time. The new arrangement will be an aid to operators in the Slocan and Ainsworth districts, who have been handicapped for several months past because of inability to market their product under the old terms.

El Salvador Mines Without Funds, Directors Declare

El Salvador Silver Mines Co., of Pine St., New York, and having properties in El Salvador, has announced to its stockholders that its general manager, Frank M. Estes, reports that the company's Divisadero mines must be considered as worked out. Mr. Estes also describes the situation at certain other properties operated by the company and concludes by recommending "that all the properties be put on a permanent non-producing basis and that the company's attention be turned to more attractive fields." The company possesses considerable equipment, it is said, which, however, the directors think is of little cash value because of its remote location. The directors declare the company is without funds to carry on its business and that steps should be taken to protect its assets until they can be liquidated.

Bankruptcy proceedings were recently begun against the property of T. H. Frothingham, one of the company's directors. The *Evening Sun* on Dec. 14 stated that forty El Salvador stockholders charged that Frothingham transferred about \$1,500,000 in securities and personal property to his wife and preferred creditors.

Anaconda Informs Stockholders As to American Brass

Details of Proposal Announced—Study of Manufacturing Situation Showed Domination by Brass Company

Details of its proposal to acquire control of the American Brass Co. have been put before stockholders of the Anaconda Copper Mining Co. in a circular issued by the latter. The circular states that a definite offer was made on Dec. 15 to American Brass shareholders to acquire not less than 51 per cent of the stock of their company at a price per share of \$150 cash and three shares of Anaconda stock, par value \$50 per share. This proposal resulted in the organization of a stockholders' committee, which will represent the stockholders of the Brass company.

The procedure to be followed is outlined as follows: Of Anaconda's authorized capital of 3,000,000 shares, 668,750 shares remain unissued. Of these, 233,125 shares will be offered to stockholders of record Jan. 3, 1922, for subscription in the ratio of one share of new stock for every ten shares of stock then owned by the stockholders, this to provide part of the payment that will be required to be made for the American Brass stock. Such subscriptions and the payment for them will have to be made before the close of business Jan. 25, 1922.

It is stated that the plan could not be carried into effect without the assistance of a syndicate to underwrite at \$50 per share the 233,155 shares of stock that will be offered to the Anaconda shareholders as stated above, and also to furnish the additional cash that will be needed to pay the Brass shareholders for such of their shares as will be acquired. The maximum obligation thus imposed upon the syndicate is, therefore \$22,500,000.

If the amount of Brass shares which may be acquired by Anaconda shall require a payment in cash in excess of

the \$11,656,250, which will be realized upon the underwritten offer of stock to shareholders of the company, the United Metals Selling Co. will assume an obligation to reimburse the syndicate for the excess to be furnished by Feb. 1, 1923, with interest, and the selling company will receive from Anaconda an equivalent of such obligation in shares of Brass company acquired by Anaconda, valued at \$300 per share, or other securities of equal value.

It was last February when the Anaconda company began to study the manufacturing and fabricating situation in the United States. It found that there were then manufacturing and fabricating copper products about thirty-two concerns of sufficient importance to be taken into consideration. The annual output of these exceeded 1,800,000,000 lb. of copper. This capacity was more than twice the pre-war domestic demand and probably 80 per cent more than required in the United States in 1919 and 1920 respectively. It thus became evident to the company that it was inadvisable to build another plant. The Anaconda company also learned from its study that the American Brass Co. dominated the manufacturing and fabricating situation in copper and brass.

Control of American Brass Co. A Constructive Step

Houghton—Opinion in the Michigan copper district is that control of the American Brass Co. by the Anaconda company would be a most constructive step. In the Lake and other districts outside of Montana the deal would have no immediate effect, it is believed. Though mines other than those controlled by Anaconda would be deprived of the American Brass market, Anaconda necessarily would relinquish other domestic markets and foreign metal business as well, leaving these open to the competition of the mines of the Lake and other fields. By putting Anaconda in a position to undersell competitors in fabricated products, which is considered here to be a likely development, control by Anaconda of the largest consumer of copper in the United States would ultimately force other companies, either independently or in groups, to enter the manufacturing field, in the opinion of leading mining men of the Lake district. This would close the breach between producer and fabricator and put the mining and marketing of copper and the manufacturing and marketing of copper and brass products in better balance as regards prices and products, establishing reasonable prices for such products and giving to the producer his rightful share of the profits of the business throughout its various stages. It is considered here that Anaconda is leading the way to a condition of affairs which will stabilize the copper market and give the producers better control of it, to the mutual advantage of the producers and the consuming public. Such a consolidation of interests is regarded as inevitable.

Iron Cap-Arizona Commercial Suit in Progress

Numerous Witnesses Called for Both Sides—H. V. Winchell for Plaintiff

The Iron Cap-Arizona Commercial apex suit now before the Superior Court of Gila County, Ariz., has developed complications that have to do with whether a faulted orebody shall be considered as continuous, without respect to the faulting. Witnesses called for Arizona Commercial included Guy N. Bjorge, for several years geologist of the Old Dominion, near by; W. S. Sultan and Pat Rose, respectively superintendent and foreman of the company during the Amster administration; R. H. Boyd, former superintendent of the mine and now with the Copper Queen at Bisbee; and H. V. Snell, of Globe. On the Iron Cap side the witnesses included Horace V. Winchell, W. H. Wiley, of San Francisco, and R. H. Hunt, of Los Angeles. John P. Gray, of Coeur d'Alene, and Burton E. Eames, of Boston, are special counsel for the Iron Cap, with Morris & Mallot as local representatives. In charge for the Arizona Commercial is Edward F. McClennan, of Boston, assisted by Ellingwood & Ross, of Bisbee, general counsel for the Phelps Dodge Corporation, and C. L. Rawlins.

The suit on trial is one brought by the Iron Cap Copper Co. to quiet title to a group of patented lode claims known as the Iron Cap, Columbus, Olympia, Marjorie and Free America, within which are orebodies claimed to apex on Iron Cap ground. The Arizona Commercial Mining Co. has filed suit in Massachusetts, seeking to enjoin the Iron Cap from taking ores from these claims, wherein from bodies claimed to apex on Arizona Commercial ground, allegation is made that the defendant company has taken 200,000 tons of ore, valued at \$3,000,000. Charles S. Smith of Lincoln, Mass., president of the Arizona Commercial has been present.

Jerome Verde Transfer Time Extended

The time within which Jerome-Verde stockholders may exchange their shares for certificates in the Jerome-Verde Development Co. has been extended until March 10. About 90 per cent of exchanges have been made thus far. All who do not exchange will be given cash in accordance with the terms of the agreement between the old corporation and the United Verde Extension, which controls the new organization.

Finnish Iron Ore Investigated

By Cable From Reuters to
"Engineering and Mining Journal"

Helsingfors, Dec. 20—An investigation recently made of the iron ore deposits in the Island of Jussaroe in the Gulf of Finland is said to show that the deposits cover a large area and run 40 per cent iron. Steps are being taken for commercial exploitation.

Colorado Fuel & Iron To Expand at Pueblo

Increased Scale of Operations at Steel Mills To Be Reflected at Iron and Coal Mines

The Colorado Fuel & Iron Co. announces that on Jan. 1 it will commence the expansion of operations at the Pueblo steel mills, which will result in the employment during January of approximately 2,000 more men at the plant.

The increased operations at the steel plant will also necessitate the employment of a larger number of men at the company's coal mines in Las Animas and Huerfano counties, the reopening of the lime quarries at Lime, and the iron mines at Sunrise, Wyo.

Operations at the steel plant have been at a minimum since August of this year, when the plant was practically closed down on account of the high price of coal and other operating costs. During November a 30-per cent wage reduction was put in effect at the coal mines, and a 10-per cent reduction in wages at the steel mills, commencing Jan. 1, has been agreed upon.

The resumption of operations means that an annual payroll of at least \$10,000,000 will be started, and that the railroads serving the plant will benefit to the extent of an equal amount in freight receipts during the coming year.

Next Mining Congress Convention at Cleveland

Arrangements have been completed by the American Mining Congress to hold its 1922 convention in Cleveland, Oct. 9 to 15. The convention will be held in the new Exposition Hall which is being built by the City of Cleveland at a cost of \$6,000,000.

Hoover Heads Colorado River Commission

President Harding has appointed Secretary Hoover as Federal Chairman of the Colorado River Commission, recently created jointly by Congress and the seven states traversed by the river, according to an announcement by the Department of Commerce. The appointment has been made with the approval of the governors of the states concerned. The creation of this commission is a step in what promises to become a great national improvement involving over a term of years an expenditure of several hundred millions of either public or private funds. Each of the states of California, Arizona, Nevada, Utah, Colorado, Wyoming, and Montana is interested in the irrigation and power to be derived from the river, and considerable conflict has already developed. The department says that unless the river problems are considered as a whole there is likely to be a great waste both in water and power, through private or public grabbing or ill-considered plans, with much conflict both between the states and with private interests.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

I. C. C. To Hear Ore Shippers on Freight Rates

Dates Set for Hearings for Coal, Iron
Ore and Petroleum Representatives
Before Commission

Since the mining industry furnishes more tonnage to the railroads than any other class of activity, representatives of that industry are following very closely the inquiry which the Interstate Commerce Commission is making into the matter of railroad rates. The railroads already have presented a part of their case and have been allotted four days, beginning Jan. 11, to complete their testimony before the Commission. Three days then will be allowed for the cross-examination of the carriers' witnesses. On Jan. 19 and 20 the

representatives of the coal and coke industry will present their views as to the advisability of reducing railroad rates on those commodities. On Jan. 21, 22 and 23 representatives of the iron ore industry will appear. No specific allotment of time has been made for other metal-mining activities, but representatives of those industries will have a chance to appear during the week of Jan. 30, all of which has been allotted to general testimony from shippers and the public. Petroleum and petroleum products is given a day's time to present the case for that industry. This testimony will be taken on Feb. 11. Other mining activities also will have an opportunity to be heard on Feb. 21 and 22 which have been assigned to "other commodities." Ar-

rangements to be heard, however, must be made in advance.

Dolbear War Mineral Case Settled

Final settlement has been made under the liberalized War Minerals Relief Act of the widely known Dolbear case. Under the amended act the Comptroller of the Treasury no longer felt called upon to withhold payment and Mr. Dolbear has received his money.

Navy To Sell Metal

The Navy Department was to have opened bids Dec. 30 covering the sale of 215,020 lb. of surplus brass, copper, bronze and aluminum. The material is at the Norfolk Navy Yard.

NEWS BY MINING DISTRICTS

Johannesburg Letter

Transvaal's October Output of Gold
Greater Than September's—New
Modder Holds Annual Meeting
—Joint Committee To Study
Labor Problems

BY JOHN WATSON

Johannesburg, Nov. 15—The Transvaal's gold output for October, declared on Nov. 10, shows an increase of 16,729 fine ounces, as compared with that of September. The value, however, decreased £155,729, owing to a fall of 7s. per oz. in the price of fine gold as compared with September. Forty-two properties sent in returns, and of these two-thirds have registered increases, the most notable being that of Van Ryn Deep, an increase of 3,148 oz., New Modder, 2,284 oz. increase, and Government Areas, 2,061 oz. increase. The only notable decrease was that Randfontein, which declined 1,758 fine ounces. The increased output was probably attributable to the increased native labor returns, which show 3,100 more natives at work than in September.

The New Modder's annual meeting was held recently. The mine has had a record year, both as regards the scale of operations and the profit earned. The total profit was £1,720,202, of which £751,427 was obtained from the gold premium. Sir Evelyn Wallers, the chairman, showed that of the mine's 1,264 total claims, 361 (or about 28 per cent) are worked out, 378 are developed and 525 claims still remain to be developed.

Reference was made, in a recent letter, to the conference of mine workers addressed by the Premier (General Smuts). A second conference was held on Nov. 10. at Johannesburg, with a view to increasing the efficiency of native underground labor. Representatives of the government mining department, the Transvaal Chamber of Mines, and the various mine workers' unions were present. General Smuts presided. It was decided that a sub-committee should consider the question of the ratio of white to colored labor underground, also the matter of getting a better day's work out of the underground native. The subcommittee agreed upon is to be composed of two representatives from the government, two from the Chamber of Mines, two from the Mine Workers' Union, and two representatives from the Industrial Federation. The committee was to start work today (Nov. 15).

MEXICO

Chihuahua

Torreón Smelter To Resume Operations
Immediately

Torreón—The Cia. Metalurgica de Torreón will resume operations on Jan. 2, when it is expected that two of the furnaces will be blown in. This plant is owned by the Cia. Minera de Peñoles and has been under course of repairs for the last six months. The capacity of the furnaces has been increased by supplanting the old ones with those taken from the big Mapimí smelter, which has been dismantled.

CANADA

British Columbia

Britannia Mining & Smelting Co.'s New
Mill—Amber Discovered at
Coalmont

Victoria—The time for the receipt of tenders for the steel work of the Britannia Mining & Smelting Co.'s new mill building, which will replace the wooden building destroyed by fire last February, closed Dec. 14. The new mill building will be constructed of fabricated steel and reinforced concrete. It is estimated that the steel work will cost between \$150,000 and \$175,000 and the completed building about \$500,000.

The crushing machinery, which will consist of one set of 20 x 72-in. rolls, four sets of 20 x 54-in. rolls, and eighteen 7 x 10-ft. tube mills, has been ordered from the Taylor Engineering & Manufacturing Co., of Allentown, Pa. The construction of the new mill, which will have a capacity of 2,500 tons of ore per day, will be supervised by Bradley, Bruff & Labarthe, of San Francisco. The town of Britannia Beach, which was destroyed by flood recently, will be rebuilt on higher ground, where it will be impossible for such a disaster to recur.

The result of the verdict of criminal negligence found against the Britannia company by the coroner's jury that passed upon the recent disaster by flood at Britannia Beach has been that the Attorney General of British Columbia has entered suit against the manager and engineer of the Britannia

company for criminal negligence, and Wilfred Dion, who lost a wife, a child, and his household effects in the disaster, is suing the company for damages. This is a test case. Other writs have been issued, but will not be pressed until this case is decided.

The Granby Consolidated has entered suit in the Supreme Court against the Attorney General of British Columbia, asking for a declaration of its rights and liabilities under the British Columbia Taxation Act.

Actual mining done during 1921 in the Nanaimo Mineral Survey district, which takes in Vancouver Island and a considerable section of the British Columbia lower mainland, has not been equal to average years, though a report prepared by William M. Brewer, resident mining engineer, indicates that there has been considerable development work and a tendency has been displayed by operators to prepare for better market conditions.

Hazelton—All the vast territory known as the Omineca, the Peace River district, and the Cariboo are included in the area over which John D. Galloway, resident mining engineer, has jurisdiction. As to mining conditions in 1921, Mr. Galloway reports that there was little lode-mineral production, but that the placer gold output increased substantially. Many properties were under development and considerable prospecting was done. There are now in the northeastern district, according to Mr. Galloway, a number of prospects, which should prove attractive to those who are looking for prospects. Placer mining was vigorously pushed in the Cariboo in 1921. The old Bullion mine, at Quesnel Forks, once the most important hydraulic mine in British Columbia, was reopened. The Silver Standard mine and concentrator at Hazelton, were closed all of the year, but it is expected that operations will be resumed in the spring of 1922. Development of a promising coal property on the Telkwa River was started during the year. This property is known as the Betty mine.

As far as known, the only ore shipments made this year were a carload of concentrates from the Silver Standard (clean-up of mill bins), a shipment from the Hazelton View, and a few tons as test shipments from different properties. The production of placer gold was estimated at \$80,000, as compared with \$69,000 in 1920.

Alice Arm—Considerable road work has been done in the Alice Arm district in the last few months. There is now a good trail up the Illiance River Valley, and the Provincial Mines Department has assisted in trail construction on the northeast fork of the Kitsault River as well as in other parts of the district. This is facilitating actual mining as well as prospecting. The Moose group, in the Kitsault River section, has considerable ore in the bunkers awaiting shipment. Development work is said to have disclosed a large body of ore.

Stewart—The Bear River Bridge, which was washed out recently, is being replaced by the provincial government. The Salvator group, on the south side of the Marmot River, will be worked all winter.

Coalmont—It is stated that a discovery of amber has been made on the property of the Coalmont Collieries, in the Coalmont district. The favorable opinion of Edwin S. Oliver, of the Oliver Chemical Processes Syndicate, as to this respect, is said to have been confirmed by reports made on samples forwarded to Ottawa and New York chemists.

Trail—The Consolidated smelter received 5,756 tons of ore from Dec. 15 to Dec. 21 inclusive. Of this the Josie mine at Rossland shipped 102 tons and company mines the rest.

Nelson—Organization of the newly-formed Mining Association of Eastern British Columbia has been completed, and the following officers named: President, R. Randolph Bruce, Windermere; vice president, J. P. McFadden, New Denver; secretary-treasurer, W. H. Burgess, Kaslo; executive, W. A. Cameron, New Denver; James Anderson, Kaslo; E. G. Montgomery, Kimberley; W. T. McDowell, Ymir; Douglas Lay, Rossland; S. S. Fowler, Riodel; L. H. Biggar, Slocan City; Clarence Cunningham, Alamo; T. W. Bingay, Trail; S. G. Blaylock, Trail; J. H. Turner, Nelson. The organization's activities, it is expected, will be largely directed towards securing of legislation favorable to the mining industry.

TEXAS

Sulphur Beginning To Move on Gulf Coast

Gulf—It is reported in Galveston that three British steamships will load at once with crude sulphur, from the Texas Gulf Sulphur Co., for Australia. Large quantities of sulphur also have been sold to European countries. Movement of this sulphur will begin about Jan. 1, it is expected, shipments being made from Galveston, Texas City, and Freeport.

During the reconstruction period, European stocks of brimstone have become nearly depleted, and the outlook for renewed exports is bright. Another sign of an impending improvement in this industry is the construction at Galveston by the Texas Gulf Sulphur Co. of concrete storage bins and loading equipment that will make it possible to load a ship in eight hours, and will insure a large stock on hand for immediate export. It has been stated in Houston that the Union Sulphur Co., of Sulphur, Louisiana, has recently purchased the sulphur rights at Damon Mound, Brazoria County, Tex., and acreage in Liberty County.

KOREA

Unsankinko—The October clean-up of the Oriental Consolidated Mining Co. was \$92,870, compared with \$83,773 in September.

MICHIGAN

The Copper Country

Refined Copper Output for 1921 39 Per Cent of Normal—Material and Labor Costs Lower in 1922

BY M. W. YOUNGS

Houghton—Only seven properties have been in operation in the Lake district throughout the year, the Calumet & Hecla and subsidiary mines having suspended on April 1. Refinery production for the year in the district is estimated at 39 per cent of normal, including the output of the Calumet smelters. Of the seven properties in operation, only four are producers, Copper Range, Quincy, Mohawk and Wolverine. The Seneca, Mayflower and Arcadian are engaged in development work.

Production of refined copper in 1921 is estimated at 107,000,000 lb. Of this, 45,000,000 lb. was produced the first three months, leaving 62,000,000 for the remaining nine months' period of curtailment. The average per month for the nine months was 6,890,000, as compared with 22,500,000 normally.

Refined copper production fell off somewhat in December in the Michigan Lake district, the output being estimated at 7,500,000 lb. or 33 per cent of normal. Throughout the greater part of the month there were eleven furnaces in blast, against fifteen in November. Calumet & Hecla had seven, Copper Range (Michigan) three, and Quincy one. Both Copper Range and Quincy continued to add a few men to their underground forces.

Copper Range, Quincy and the Stanton mines will finish the year with no more than normal stocks of metal on hand. Calumet & Hecla, however, still has a considerable surplus in spite of a large volume of sales throughout the year. These stocks are at least sufficient to prolong the period of suspension of mining operations until spring and when production is resumed it probably will be on a basis of not more than 50 per cent at the start.

Quincy, it is estimated, will finish the year with a production close to 15,000,000 lb., as compared with 19,216,070 in 1920. Quincy started to curtail in 1920 owing to depressed conditions and on April 1 of this year made a more drastic curtailment, working on a four-day schedule instead of six. In November there was a return to almost a full-time basis but forces were not materially increased. The tenor of Quincy rock shows no falling off with depth.

Copper Range will produce upwards of 30,000,000 lb. this year. A particularly pleasing development at the Copper Range mines has been the steady improvement in the character of the ground opened in Trimountain, where a heavy program of drifting has been in progress throughout the year. The rock in the Champion mine continues rich and though Baltic has shown no improvement the average yield for the three mines for the year should be

close to 40 lb. of copper per ton of rock stamped.

Mohawk's production for the year was approximately 14,000,000 lb., and Wolverine's about 4,000,000. Mohawk is carrying on a normal program of development work and producing to the capacity of its mill.

Of the properties under development, Seneca is the most advanced and should become a regular producer on a fairly large scale in the latter part of 1922. Before this stage is reached a new hoist must be installed at the Seneca shaft.

Arcadian Consolidated has resumed sinking in the New Baltic shaft, which will be sunk to a depth of 1,060 ft., from which level a drift will be driven south to connect with the 1,050 level of the New Arcadian shaft. This drift will parallel the south drift from the ninth level.

Mayflower, in its new operation on the 1,450 level, is getting into fairly good looking ground to the north, although considerable trap is in evidence.

Calumet & Hecla is still aggressively pushing its geological research work in an effort to establish certain rules for the location of copper deposits. Some interesting theories are being put to practical test and there is a good deal of encouragement in progress to date.

Material and labor costs will be about normal in 1922 and will have a favorable effect on mining costs. High freight rates still continue, however, and this will be the biggest abnormal factor in cost items.

Gogebic Range

Overwinding Accident at Pabst Mine—Mild Weather Aids Stripping

Ironwood—An overwinding accident occurred recently with the electric hoist at "H" shaft of the Pabst mine, with some damage to the equipment but no other serious results. It is thought that one of the skips, which are run in balance with a single drum, was lowered a hundred feet or so below the dump when the other was rung up from the bottom to the next level to be filled. This was far enough to release the lock on the reverse gear of the hoist and permit the engineer to reverse the hoist, which he evidently did when he next started up. The empty skip was pulled up to the sheave, the 1½-in. rope was broken and the skip dropped 2,000 ft. to the bottom of the shaft. The shaft was not damaged except at the bottom, and the safety devices, of which the hoist had two independent systems, stopped the hoist before the rope was in the engine house. There must have been some error in the setting of the safety stops although they were checked at frequent intervals. The safety stops used were of the most modern type.

Mild weather has continued surprisingly long this winter and been a great aid to the stripping operations under way at the open pits. Past the middle of December the thermometer did not drop below 15 deg. and was often above 25 deg. above zero.

Marquette and Menominee Ranges

Three Mines Resume on Menominee Range—Cleveland-Cliffs Unwatering North Lake—Imperial Mine Hoisting Ore

BY WILLIAM N. NEWETT

Ishpeming—The Fogarty and Baltic mines of the Verona Mining Co. and the Balkan mine of the Balkan Mining Co., on the Menominee Range, have resumed mining operations. Both companies are subsidiaries of Pickands, Mather & Co. The Balkan has been closed since June; the other two since August. About 350 men have been given employment on a full-time basis. The wage scale varies from \$2.10 on surface to \$2.75 underground and is far below the scale which was in effect when the properties were shut down.

Rapid progress is being made with the construction of the blast furnace which is to be operated in connection with the West Chapin Mining Co. and a large part of the material is now on the site. It is planned to erect a chemical plant later. The furnace will produce charcoal iron and will be the fifth furnace of this type in the Lake Superior region. None of these furnaces is being operated at present, but the one at Marquette, belonging to the Pioneer Iron Co., will be blown in as soon as repairs now being made to the stack are completed.

The Cleveland-Cliffs Iron Co. has started the task of unwatering North Lake, which is a short distance from the company's Barnes-Hecker mine on the Marquette Range. Considerable water was encountered underground and it was thought that the lake water was finding its way into the workings. There are 368,000,000 gal. of water and silt to be removed from the lake. About one-half is silt. Electric-driven centrifugal pumps will be used in the work. It is estimated that five months will be required to unwater. The water will be sent to the Carp River. This is the second instance where the Cleveland-Cliffs Iron Co. has unwatered a lake. Some years ago Lake Angeline, in Ishpeming, was pumped out. About 800,000,000 gal. was handled.

The Imperial mine is now hoisting ore, the skips having been placed in commission a few days ago. This is the first iron mine to be opened by Henry Ford. About 160 men are employed. All ore will be placed in stock for shipment to the River Rouge furnaces next season. Ford's wage scale is \$4.80 a day for the first thirty days, then \$6 a day. The scale applies to all alike.

MINNESOTA

Riverton—Extensive surface-plant improvements have been made during the last two months at the Sagamore mine of the John A. Savage Co. Foundations were laid for a screening and drying plant which is believed will be the largest and most modern structure of its kind in the Superior district.

COLORADO

Shutdown of Moffat Road Postponed—Mine Executives To Meet at Denver—C. F. & I. Co. To Increase Operations at Pueblo

(From Our Special Correspondent)

Denver—Court proceedings which threatened the immediate closing down of the Moffat railroad have been postponed, pending adjustments which it is hoped will bring the revenues of the company to a level approximating operating costs. In granting an extension, Judge Johnson scored residents and business men in the territory served by the road for their failure to co-operate with the company by diverting business legitimately belonging to this line, to other carriers. The road serves the northwestern part of the state, and a territory rich in agricultural and mineral resources, but, owing to its heavy grades over the Continental Divide, is expensive to operate.

The response to an inquiry sent out by the Colorado Metal Mining Association has been so general, that the executive committee has decided to arrange for a conference meeting of mine managers and superintendents to convene during the annual meeting of the association in January. The conference will be held on Jan. 16, at the State Capitol Building in Denver, and will consider problems directly connected with mine operations.

Telluride—Shipments of concentrate during November were as follows: Smuggler-Union, 60 cars; Tomboy, 45 cars; total 105 cars.

Cripple Creek—The Moonlight Gold Mining Co. has developed a shoot of \$15 ore in territory west of the old shaft.

Alma—The Queen company, operating on Mt. Bross, has started its air compressor and is cutting a station at the breast of its main tunnel to instal a diamond drill. Present plans call for about 2,000 ft. of drilling, the holes to be run at about 45 deg. to the course of the main tunnel to prospect the lateral veins.

The application of the Colorado & Southern to reduce service on the South Park branch to tri-weekly, does not seem to be warranted, as the company is failing to make prompt delivery of freight sent over the line, under the six-day service.

The Louisiana & Colorado Mining Co. has reduced its force for the winter, and is cleaning up and shipping the high-grade silver ore mined to the A. V. smelter at Leadville.

The new buildings being erected on the Silver Wave property are ready for occupancy. The force has been increased and is now working two shifts on the new lower tunnel, which when completed will cut the known oreshoot at a greater depth and several hundred feet in advance of the old workings.

The Pulaski Investment, Mining & Prospecting Co., operating on Penn-

sylvania Mt. from the Mosquito side, is building a new concentrating and flotation mill to treat the low-grade ore which it is developing. The ore-body at present is about 24-ft. wide and carries gold, silver, lead and zinc. Connections are being made with the lines of the Colorado Power Co. All units of the mill and mine are to be operated by electricity.

The recent gold strike on the Hard To Beat property is holding up well. Buildings have been erected and a crew of eight men is employed on development. One car of high-grade gold quartz has been shipped to the smelter.

The London Co. is working two shifts on the new raise which is being driven from the 2200-ft. point in its new lower tunnel to connect with the working of the old Extension property.

Several sets of lessees are working on the South London and are maintaining a monthly output of four to five cars of gold ore, assaying 6 to 8 oz. gold per ton.

The engineers who have been examining the North London workings completed the sampling and geological work the first of the month. If this examination proves satisfactory a new mill will be installed in the early spring.

SOUTH DAKOTA

Cutting Company Resumes—Golden Feather Mill Nearly Completed—Golden Crest Preparing for Work—State Mine Inspector's Report Out

Lead—According to the annual report of Otto Ellerman, State Mine Inspector, for the year ended June 30, 1921, the gold mines treated 1,572,989 tons of ore having a value of \$5,712,853. This was distributed as follows: Homestake, 1,484,391 tons valued at \$5,354,038; Trojan, 88,598 tons valued at \$358,815. Placers, \$1,000. The Refinite Company used 1,000 tons of aluminum silicate in the manufacture of water softener. The U. S. Gypsum Co. mined 8,223 tons of gypsum. The Dakota Plaster Co. treated 3,933 tons of gypsite. The King Mica Co. shipped one car of mica and Dennis Henault shipped 6 tons of the same material. The Maywood Chemical Co. shipped 950 tons of lithia ore to its refining plant in New Jersey. The quarries were active with an increased production of limestone and structural materials. The coal mines produced 9,000 tons of coal.

There were employed in the metal mines during the period covered an average of 1,717 persons. The coal mines employed thirty-three and the quarries 158.

There occurred 565 accidents, classified as follows: Fatal, three; serious (time lost more than fourteen days), 86; and slight, 476.

The general mining conditions show an improvement. The labor situation has been relieved and there is a tendency towards a return to normal with

increased activity in all branches of the industry.

Deadwood—The Cutting Mining Co., has resumed work at its property and the shaft is being unwatered. New pumps are being installed and development work will be started at the 500 level as soon as the water is removed.

The Golden Crest property is being put in shape for continued work. The force will be increased after Jan. 1 and it is probable that the cyanide plant will be placed in commission this coming year.

The Golden Feather mill is nearing completion. Ten stamps are being installed and will be ready for operation during January. Amalgamation will be used at the start but a cyanide annex will be added soon. This company has taken over the Monarch mine and will work it along with its own property.

At the Eagle Bird the tunnel is being continued and has reached a distance of over 900 ft. There remains 600 ft. to drive and this will be completed early in 1922.

NEW MEXICO

Mining in the State Reviewed—Eighty-five Mine Principal Shipper—Mogollon Active

BY JAMES P. PORTEUS

Lordsburg—The salient features of mining in New Mexico during 1921 were the comatose condition prevailing in the copper industry, the steady production of gold and silver in the Mogollon district, a decrease in zinc, lead, silver, iron, manganese, and fluorspar production generally with the closing of many mines, and, more specifically, the blocking out of a large quantity of siliceous copper ores in the Calumet & Arizona's Eighty-five mine, in the Lordsburg district. The big copper properties with plants at Santa Rita, Hurley, and Tyrone were affected like all others in the Southwest, and are still marking time. The Pterro-Hanover camp became inactive when the zinc and iron mines shut down about Oct. 1.

A reduction of freight rates on zinc ores to the Kansas smelters from this field, recently made, looks favorable, but a corresponding reduction in iron and manganese rates must also be made before these commodities can move. Copper ores were shipped continuously from the Lordsburg district until Nov. 1. The ore shipments from this district for the last twelve months from Dec. 1, 1920, to Dec. 1, 1921, amounted to 355 carloads, a total of 17,222 tons of copper and silver-lead ores. The approximate value was \$275,555. The bulk of this tonnage has come from the Calumet & Arizona's Eighty-five, which was a steady shipper up to Nov. 1 when the smelter stockpiles were reported full. Ores extracted since then have been stored in pockets, bins, and dumps at the mine. No stoping was done during this period; only ores mined in course of development were moved. It is estimated that the ores blocked out

in the last year would more than pay the purchase price of the property, which was bought about eighteen months ago for over a million dollars.

The Co-operative mine has shipped during the year a total of about 600 tons of lead-silver ores to the El Paso smelter. The total value was \$34,200, an average of \$57 per ton. The Last Chance mine was taken over early in the year by John H. White and associates, and work was started in April. Since that time about 30,000 tons of straight silver ore, averaging 15 oz. or better, has been blocked out. A fifty-ton mill and a power house are being built.

The Mogollon Mines Company at Mogollon, continued working steadily throughout the year. Its production for eleven months up to Dec. 1 has been 5,544 oz. gold and 280,000 oz. silver, compared with 5,400 oz. gold and 289,000 oz. for the same period last year. Ore milled by the company has amounted to 44,915 dry tons in eleven months this year, compared with 37,979 dry tons in the same period last year. This ore came from the Last Chance, Confidence, and Deadwood mines. Lump fluorspar ores from Lordsburg and a milled product from Las Cruces were shipped intermittently.

ARIZONA

Tom Reed Mill To Handle Custom Ores

BY JAMES H. MCCLINTOCK

Kingman—The Tom Reed Gold Mines Co., at a directors' meeting in Los Angeles, gave W. B. Phelps, superintendent, authority to contract with mine owners of the Oatman section for the milling of custom ore, the contracts to be based on the percentage of recovery shown in compiling the results of a two-weeks' experimental run recently completed. The mill has been making as high as a 98 per cent saving on Tom Reed ore, in gold and silver. There is little in the Tom Reed ore save silica and the precious metals. The mill is expected to care for about 125 tons a day.

About 50 tons a day of Big Jim ore, brought by tramway, are being handled in the United Eastern mill. The main shaft of Big Jim is being carried down to the 750 level.

The mill of the C.O.D. Mines Co. has resumed operation, with W. Rith in immediate charge. About fifty miners are taking out ore. The main shaft is 500 ft. deep.

Globe—E. G. Deane, manager of the Superior & Boston, states that the company within a short time will be employing its full crew of 125 men. Miners are now being employed for stoping on the 400 and 600 levels of the Footwall vein. Medium-grade copper-silver ores are to be sent to the International smelter at Miami, the higher grade being held until resumption of copper smelting at El Paso. This better ore samples about 8 per cent copper and 30 oz. silver.

CALIFORNIA

Central Eureka Gets New Option on South Eureka

San Francisco—According to local reports the blue sky law of California has begun to show its teeth. In connection with the Silver Hills of Nevada fiasco, it is alleged that Don C. Aldridge, a stock broker, manipulated the prices for this stock by a system of "cross sales." Aldridge's license has been revoked by the commissioner of corporations. It will be remembered that W. J. Loring, president of the company, issued a statement in September, 1921, to the effect that the Silver Hills property was practically worthless and that the company would endeavor to find another mine. (*Eng. and Min. Jour.*, Oct. 29, 1921, p. 714.)

Grass Valley—The North Star Mines Co. is increasing its activity in development work, particularly upon its lowest levels.

Control of the "Bullion" property by the Intermountain Development Co., of Salt Lake City, is announced in local reports which intimate that work on the property may be resumed.

Sutter Creek—Central Eureka has secured a new option on the South Eureka. This amounts to practically a renewal of the old one and gives Central Eureka until Feb. 1, 1923, for further development of South Eureka's ground. A new 85-ft. steel headframe and electric hoist are almost completed and the physical appurtenances of this mine are in excellent condition for further development at depth.

Redding—The wire rope tram from the Hornet mine of the Mountain Copper Co. to Mathewson on the Southern Pacific will be put in commission Jan. 15, 1922, it is reported.

Downieville—The Wheeler mine in the Downieville district is reported to be milling gold ore from a promising vein.

NEVADA

Simon Silver-Lead Flotation Plant Increasing Tonnage—Rochester Silver's November Output Above Normal

Rochester—November production by the Rochester Silver Corporation was 5,071 tons, recovered value \$68,000, and operating profit \$21,440. This is above normal for this company, although October was also a good month, production being 4,780 tons and recovered value \$63,000. Mine conditions are said to be good, with ore of excellent grade being mined from a lens opened up in October in the foot-wall section of the east vein on the 100 level.

Mina—The flotation plant of the Simon Silver-Lead Mines Co. is now being operated two shifts and tonnage gradually increased. The plant was shut down for four days during the second week in December owing to discontinuance of electric power during that time. The first car of silver-lead concentrates has been shipped to the

smelter at Midvale, Utah, and there is a car of zinc concentrates ready for shipment to the company plant at Harbor City, Cal. At the Mabel mine, operated under option by the West End Consolidated Mining Co., of Tonopah, the shaft has reached a depth of 100 ft. below the tunnel level and a station is being cut preparatory to crosscutting to the veins and drifting.

Divide—The Tonopah Divide mine's production for November was 1,741 tons, average value per ton being \$29.12, and the gross value \$50,697. This is approximately the same as for the previous month. A new double-drum hoist was installed in December, and production was curtailed for nine days. The usual development footage is maintained, with no new developments of importance. Shaft sinking will not be resumed until the 1,200 stations are completed.

Royston—Many leases are being operated in this district, and claim owners are busy. Some ore is being saved from development work, but the district is hardly on a self-sustaining basis as yet. In the Betts, or original strike, the incline shaft passed into the foot wall of the ore at a depth of 40 ft. The shaft was continued to a depth of 53 ft. and a crosscut has been started from the bottom toward the west to cut the ore on its dip. The Hudson Mining Co., owner of the principal portion of the district where the development is actually being done, is preparing to continue sinking its 300-ft. incline shaft to the 600 level.

Tonopah—Production continues normal in this district. Bullion shipments for November totaled about \$650,000. The Tonopah Belmont has reported favorable developments on new ore-bodies from 1,100 level. Wages were reduced at the West End on Dec. 16 to conform to the scale paid by other Tonopah companies. General conditions throughout the district were about as usual, with no new discoveries of importance reported. Labor conditions are good.

Pioche—Ore shipments from the Pioche district for the week ended Dec. 23 were confined to the Bristol and Black Metal properties which continue to ship an average of 60 tons each daily to the Salt Lake smelters. The Bristol production is largely a silver-lead-copper ore which fluxes satisfactorily, and that from the Black Metals mine carries an average of 14 ounces silver and only 1 per cent of insoluble, the ore being limestone impregnated with argentiferous manganese and iron. Leasers' ore is going out from an increased number of small properties, a recent car carrying four lots. The total tonnage shipped for the week was estimated at 770 tons.

Ely—A shipment of copper, consisting of 35 cars, was dispatched from McGill Dec. 10. This represents the final clean-up of the copper stored at the smelter of the Nevada Consolidated Copper Co.

UTAH

Tintic Shipments Decrease—To Unwater Lower Levels in Gemini and Ridge Valley

Eureka—The Tintic Standard has declared a dividend of 5c. a share. This company's new mill is producing 3,000 ounces of silver and 1,000 lb. of copper daily. Reserves of mill ore in the mine are estimated at 511,000 tons, and reserves of shipping ore at 343,000 tons. Recoverable metal from the low-grade ore is placed at \$12.08 and from the high-grade at \$34.05 a ton.

Shipments from the Tintic district for the week ended Dec. 19 amount to 156 cars as compared with 176 cars the week preceding. Shippers were: Tintic Standard, 49 cars; Chief Consolidated, 39; Chief Consolidated, 13; Victoria, 12; Iron Blossom, 10; Eagle & Blue Bell, 9; Centennial-Eureka, 9; Dragon, 8; Colorado, 5; Mammoth, 3; Empire Mines, 3; Swansea, 3; Gemini, 3; Bullion Beck, 2; Alaska, 1.

Water is receding in the lower workings of the Gemini and Ridge Valley mines and it is proposed by the management to further lower the level by pumping, which it is thought possible with the present equipment. The water will be pumped into open fissures. With the lower levels unwatered leasing in these properties is likely to be greatly stimulated.

Park City—Shipments for the week ended Dec. 19 were 2,430 tons of ore. Shippers were: Judge allied companies, 1,128 tons; Silver King Coalition, 867; and Ontario, 435.

IDAHO

Coeur d'Alene District

Proposed Revision of Mining Law Not Popular

Wallace—At a recent meeting of the Wallace Board of Trade the proposed revision of the mining laws was referred to a standing committee for investigation and report. The chairman of the committee is L. E. Hanley, mining engineer and secretary of the Hecla Mining Co. The following special committee was appointed to act with the standing committee: J. E. Gyde, attorney for the Bunker Hill & Sullivan company; Rush J. White, mining engineer and chairman of the Columbia section of the A. I. M. E.; Thomas H. Owens, assistant manager of the Federal Mining & Smelting Co.; J. J. Day, president and manager of the Tamarack & Custer Consolidated Mining Co.; and C. W. Newton, general manager of the Callahan Zinc-Lead Co. The committee recommended that protest be made against the bill as a whole for the reason that some of its provisions were regarded impractical and that any radical changes in the mining laws, which are now generally well understood, would result in much confusion and prove detrimental to the mining industry. The committee was authorized to prepare a formal resolu-

tion embodying this view and forward the same to the chairman of the house committee on mines and mining and to the Idaho delegation in congress.

A strike of unusual interest has been made by the Cedar Creek Mining & Development Co. on Granite Creek, about four miles from Murray. A crosscut from drift on the original to a parallel vein picked up three stringers of ore which have merged into a solid shoot of lead-silver ore, 22 in. thick.

The strike made on Lookout Mountain a few months ago is promising. Since crosscutting the vein, drifting has proved an ore shoot 75 ft. long that will average for a width of 6 ft. 30 per cent lead and 20 ounces silver. Where the vein was intersected the main ore showing was galena, but this soon disappeared and for the past 60 ft. the drift has been in a body of cerussite with streaks and bunches of dark crystals carrying 80 per cent lead. The company plans to put in a tramway in the spring which will deliver the ore to the wagon road, where it will be loaded on trucks for shipment to the Bunker Hill smelter at Kellogg. It will require a tram about 1,800 ft. long. Control of the property is owned in Kellogg.

Other Districts

Warren—Los Angeles, Cal., capital has taken a lease upon the Thomas Creek placers. Investigations are being made for a number of other concerns, particularly with regard to the monazite sands found in this section.

Featherville—The Hammon Engineering Co., of San Francisco, has shipped fifty carloads of dredging material and supplies. The company plans to invest about \$1,000,000 and two new \$150,000 dredges are being put in.

Rocky Bar—The Idaho Gold Corporation, of Salt Lake City, headed by Earl McIntyre, principal owner of the Mammoth mine, in Utah, and James Ivens, a director of the Silver King Coalition at Park City, is preparing for active operations in and around Rocky Bar. Rocky Bar figured largely in gold production in the early days. The company has acquired a considerable area.

At Atlanta, 15 miles east of Rocky Bar, interests affiliated with the St. Joseph Lead Co. are said to be doing some work.

Hailey—As a result of increased activity in Blaine County, that section will take second or third place among the mineral-producing areas of Idaho this year, according to a preliminary estimate of Stewart Campbell, state mine inspector, who states the county's increase in mineral output over 1920 will be in the neighborhood of \$200,000. Considerable attention has been directed to the region because of the activities of Bunker Hill & Sullivan with regard to deep development, having in view the picking up of commercial ore below a series of faults. Federal Mining & Smelting Co.'s production from its In-

dependence property has averaged about 20 cars monthly, and the Golden Glow re-entered the producing class with an output of 10 cars, netting approximately \$250,000.

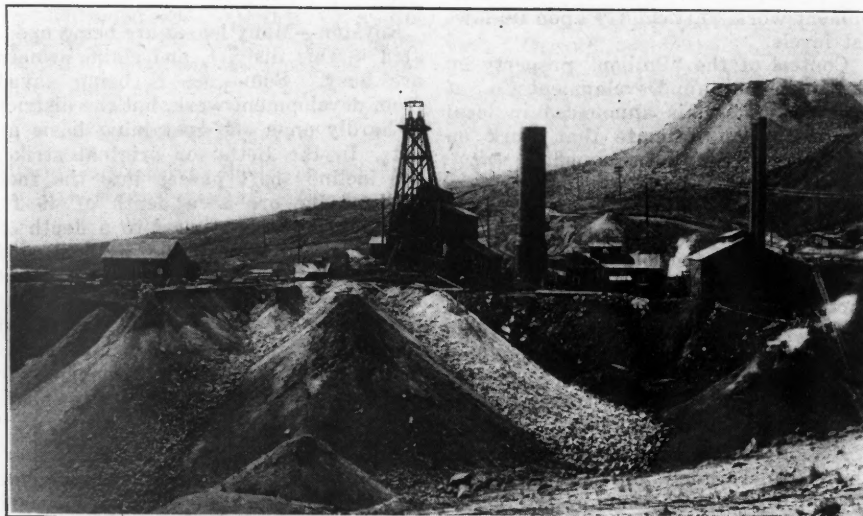
OREGON

Bay Horse Mine Expected To Resume Shipments Soon

Huntington—After negotiations extending over a considerable period, the United States Metals Co. has concluded arrangements with the Oregon-Washington R. & N. Co. for putting in a side-track just below the Bay Horse mine. The ore will be dropped from the mine to the loading bins by a gravity tram, and it is anticipated shipments will be underway to Tacoma smelter early in 1922.

carry 8 per cent copper and considerable silver. Drifting is continuing on this level and a fair tonnage is already indicated. Crosscutting is being pushed on the 2,600 level and although good speed is being made it will require two months more, it is believed, before the copper is reached at this depth.

The Tuolumne Copper Mining Co. has started sinking its Main Range shaft from the 1,600 to the 2,400 level, and in view of the fact that the zone of commercial ore has been located on the 1,600 level, it is believed, that no time will be lost in crosscutting directly to a point corresponding to this zone on the lower levels, or to drift to it, for it is considered possible that the Spread Delight vein may be cut on dip by the shaft. The ore on the 1,600 level has been continuous for some distance, it has been found.



A SHAFT OF THE TUOLUMNE COPPER MINING CO., BUTTE, MONT. Schoettner Studio, Butte

MONTANA

Anaconda Reported To Have Made Contract With Silica Gel Corporation —Hibernia Crosscut Near Vein

BY A. B. KEITH

Butte—In unofficial circles at Anaconda gossip has it that if the Anaconda Copper Mining Co. has closed a contract with the Davidson Chemical Co., as reported in all probability it has to do with the use of the new substance known as "silica gel," the patents covering the manufacture of which are held by the Davidson company. This substance enters materially into a simplified process of making sulphuric acid, in which the Anaconda company is greatly concerned in view of its proposed entry into the fertilizer manufacturing field. Silica gel because of its peculiar properties facilitates the making of high-grade sulphuric acid by a process hitherto regarded as too expensive for general use. The product is handled by the Silica Gel Corporation, which is a subsidiary of the Davidson Chemical Co.

The copper ore developed by Butte & Superior on the 2,200 level of the Black Rock mine is reported to be looking much more promising. The orebody is said to be from 8 to 12 ft. wide and to

The crosscut on the 750 level of the Hibernia is believed to be close to the vein, according to miners, who are cutting stringers and finding other evidence of the proximity of the fissures. The Hibernia is owned by the Davis-Daly Copper Co., and at present is the only property of the company in operation.

Elkhorn—Shipments of concentrates from the Elkhorn mill of the Boston & Montana Development Co. have commenced. Recovery is reported to be about 90 per cent.

MEXICO

Sonora

Mexican Corporation Gets Silla Mines

Nogales—The Silla mines, about 60 miles east of Mazatlan, Sinaloa, are reported to have been transferred to the Mexican Corporation, a holding company for the National Mining Corporation of London. The deal was made through W. J. Mitchell and Harold S. Gay, of Nogales, Ariz.

The old quartz mill at Planchas de Plata, 20 miles southwest of Nogales, has been sold as junk and will be torn down.

THE MARKET REPORT

Daily Prices of Metals

Dec.	Copper, N. Y., net refinery*		Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.	
22	13.625	32.125	32.50	4.70	4.35@4.40	4.85@4.90	
23	13.625	32.125	32.50	4.70	4.35@4.40	4.85@4.90	
24	13.625	32.125	32.50	4.70	4.35@4.40	4.85	
26	.....	.....	.....	.....	.....	.....
27	13.625	32.375	32.75	4.70	4.35@4.40	4.80@4.85	
28	13.625	32.75	33.125	4.70	4.375@4.40	4.80@4.85	

*These prices correspond to the following quotations for copper delivered: 13.875c. for the week.

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

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

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Dec.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3 M	Spot	3 M	Spot	3 M
	Spot	3 M							
22	66 $\frac{1}{4}$	67 $\frac{1}{4}$	74 $\frac{1}{2}$	170 $\frac{3}{4}$	172 $\frac{3}{4}$	25 $\frac{1}{4}$	24 $\frac{3}{4}$	27 $\frac{3}{4}$	27 $\frac{3}{4}$
23	66 $\frac{1}{4}$	67 $\frac{1}{4}$	74 $\frac{1}{2}$	171	172 $\frac{3}{4}$	25	24 $\frac{3}{4}$	27 $\frac{3}{4}$	27 $\frac{3}{4}$
24	...	...	...	....	....	...	...	...	...
26	...	...	...	....	....	...	...	...	...
27	...	...	...	....	....	...	...	...	...
28	66 $\frac{1}{4}$	67 $\frac{1}{4}$	74	172 $\frac{1}{4}$	174 $\frac{1}{4}$	24 $\frac{7}{16}$	24 $\frac{1}{2}$	27 $\frac{3}{4}$	27 $\frac{3}{4}$

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

Silver and Sterling Exchange

Dec.	Sterling Exchange "Checks"	Silver			Dec.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
22	420	99 $\frac{3}{4}$	65 $\frac{1}{2}$	35 $\frac{1}{2}$	26	....	99 $\frac{3}{4}$	64 $\frac{1}{2}$	...
23	417 $\frac{7}{8}$	99 $\frac{3}{4}$	64 $\frac{3}{4}$	34 $\frac{3}{4}$	27	419	99 $\frac{3}{4}$	64 $\frac{1}{2}$	...
24	418 $\frac{3}{4}$	99 $\frac{3}{4}$	64 $\frac{3}{4}$	34 $\frac{3}{4}$	28	418 $\frac{3}{4}$	99 $\frac{3}{4}$	65	35 $\frac{1}{2}$

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

Metal Markets

New York, Dec. 28, 1921

The extreme quietness which has characterized the metal markets during the last week was expected, and will no doubt continue until the first week of January. Although orders have been few, prices have been well maintained, which is most encouraging. In the dull periods early in the year, prices would usually be shaded in an attempt to attract business, but this is no longer the case. The reasons are that producers are in a better financial condition, and also feel that prices are likely to advance rather than go lower.

Copper

The larger producers continue to ask 14c. for first quarter deliveries, but, as was true last week, have been unable to secure domestic orders at that price. Several interests have been willing to take orders at 13.875c., delivered, and in the last day or two, two or three million pounds could have been obtained for January delivery at nearby points for 13.75c. Practically no business has been done at any level. Export orders have also declined but not to the extent that domestic business has. Prices have been firm; in fact, producers have probably netted slightly more on export

business than last week. European quotations are generally 14.125@14.25c., c.i.f.

Lead

The official contract price of the American Smelting & Refining Co. continues at 4.70c. There is some disposition to quote 5 or 10 points above this, especially for desilverized lead, but practically all of the business has been done at the lower level. It has been small. In the Middle West the market has also been quiet. Chemical lead was obtainable early in the week and possibly still is, at 4.35c. in at least one quarter, but other producers are quoting as high as 4.425c. Desilverized is selling at from 10 to 15 points premium, and good corroding lead has sold as high as 4.60c., Chicago, in the last two or three days. Some producers are entirely sold out up to February. Reports are current of American lead going to Europe. A small amount has been sold, but it is hardly a paying business yet. The London spot price fell off markedly today, the quotation incidentally being split closer than has been the case since pre-war days.

Zinc

Business has been exceedingly dull with many producers quoting nominal prices above the market. There is no pressure to sell, and with ore at present prices there is little or no more profit than was obtainable when the price of zinc was 4.25c. High-grade is in somewhat better demand at unchanged prices of 6c. with freight allowed.

Tin

Tin has also been quiet over the Christmas holiday, the absence of London quotations yesterday being an added reason for lack of interest in the local market. Electrolytic is available in small amounts at approximately the same prices as are asked for Straits. The 99 per cent grade is in somewhat freer supply, but nearly all of the tin now being handled is of the Straits variety. Tin for forward deliveries is generally quoted at the same prices as for spot.

Arrivals of tin, in long tons: Dec. 17th, Straits, 200; 21st, London, 440; 22d, Straits, 215; 23d, London, 150; 24th, Liverpool, 50; 27th, Liverpool, 365.

Gold

Gold in London: Dec. 22d, 97s. 9d.; 23d, 98s. 1d.; 28th, 97s. 10d.

Foreign Exchange

The exchange market has been exceedingly quiet at steady prices. Any decided demand would no doubt in-

crease quotations, for the market has an upward tendency. On Tuesday, Dec. 27th, francs were 8.045c.; lire, 4.405c.; and marks, 0.545c. New York funds in Montreal again declined to new low levels and yesterday were quoted at 6½ per cent premium.

Silver

The market has been featureless, with practically no business doing over the Christmas holidays, and these conditions are likely to continue until after the New Year.

The market closes dull, with tendency uncertain.

Mexican Dollars—Dec. 22d, 49½; 23d, 49¼; 24th, 49¼; 27th, 49¼; 28th, 49¾.

Other Metals

Quotations cover wholesale lots unless otherwise specified.

Aluminum—20c. per lb. for 99 per cent grade; 19c. for 98@99 per cent; 18c. for 94@98 per cent. Outside market nominal at 17@18c. for 98@99 per cent virgin grades.

Antimony—Chinese and Japanese brands, 4.50c.; W. C. C. brand, 5.25@5.75c. per lb. Cookson's "C" grade, spot, 9c. per lb. Chinese needle antimony, lump, nominal at 4c. per lb.

Iridium—Nominal, \$150@\$170 per oz.

Palladium—Nominal, \$55@\$60 per oz.

Platinum—\$80@\$84 per oz. Market quiet.

Quicksilver—\$49@\$50 per 75-lb. flask. San Francisco wires \$49.50. Market better.

The prices of the following metals remain unchanged from the figures published in these columns on Dec. 3: Bismuth, Cadmium, Cobalt, Molybdenum, Monel Metal, Nickel, Osmium, Rhodium, Selenium, Thallium and Tungsten.

Metallic Ores

Manganese Ore—23@24c. per unit, seaport; chemical ore, \$55@\$60 per gross ton, lump; \$75 per net ton, powdered. Nominal.

The market is generally exceedingly quiet, and prices on the following ores remain unchanged from the figures published in the Market Report in the Dec. 3 issue: Chrome, Iron, Magnetite, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, Zircon, and Zirkite ores.

Zinc and Lead Ore Markets

Joplin, Mo., Dec. 24—Zinc blende per ton, high, \$29.10; basis 60 per cent zinc, premium, \$29; Prime Western, \$28; fines and slimes, \$26@\$24; average settling price, all grades of zinc, \$25.67.

Lead, high, \$59.90; basis 80 per cent lead, \$57; average settling price, all grades of lead, \$58.09 per ton.

Shipments for the week were: Blende 11,142; lead, 2,498 tons. Value, all ores, for the week, \$431,190.

Around 2,500 tons of 56 per cent zinc ore was purchased on a basis of \$30, considered, with the present market conditions, a better buy by the pur-

chaser than 60 per cent zinc ore on the prevailing basis of \$28. With four points off, at one dollar per point, the ore brought about \$24 per ton.

Platteville, Wis. Dec. 24—Blende, basis 60 per cent zinc, \$30. Lead ore, basis 80 per cent lead, \$58 per ton. Shipments for the week: Blende, 84 tons. Shipments for the year: Blende, 10,896; lead ore, 1,793 tons. Shipped during the week to separating plants, 623 tons blende.

Non-Metallic Minerals

Feldspar—No. 1 pottery grade, \$6.50 per long ton; soap grade, \$7.50, f.o.b. North Carolina points. No. 1 Canadian, ground, \$23, f.o.b. Ohio points.

Fluorspar—Gravel, guaranteed 85 per cent CaF₂ and not over 6 per cent silica, \$20 to \$22.50 per ton, f.o.b. Kentucky. Enamel grades, \$32.50 to \$50. F.o.b. New Mexico points, 85 per cent grade, \$12.50 per ton; 95 per cent, \$25; 97 per cent, \$30.

Fuller's Earth—16 to 30 mesh, \$20 per ton; 30 to 60 mesh, \$20; 60 to 100 mesh, \$17; 100 mesh and over, \$15, f.o.b. Pennsylvania points. Market quiet.

Graphite—Ceylon lump, first quality, 5½@6½c. per lb.; chip, 4@5c.; dust, 2½@3½c.; No. 1 flake, 5@7c.; amorphous crude, \$15@\$42.50 per ton. All f.o.b. New York.

Talc—20 to 200 mesh, \$7@\$12 per ton, f.o.b. Vermont; \$8.25@\$13, f.o.b. points in Georgia.

Generally dull markets exist for the non-metallic minerals, and there is no quotable change in the following from the prices published in our Dec. 3 issue: Asbestos, Barytes, Bauxite, Borax, Chalk, China Clay, Emery, Gypsum, Kaolin, Limestone, Magnesite, Mica, Monazite, Phosphate Rock, Pumice Stone, Pyrites, Silica and Sulphur.

Mineral Products

Arsenic—7@7½c. per lb., f.o.b. New York; 6½@7c. for imports.

Potassium Sulphate—Powder, domestic, 90c.@\$1 per unit, basis 90 per cent, f.o.b. New York.

Sodium Nitrate—\$2.30 per cwt. ex vessel, Atlantic ports.

Copper Sulphate—Large crystals, 5.65c. per lb.; small crystals, 5.55c., f.o.b. New York.

The price of Sodium Sulphate is unchanged from the quotations published Dec. 3.

Ferro-Alloys

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 12c. per lb. of chromium contained; 4 to 6 per cent carbon, 13c., f.o.b. works.

Ferromanganese—English and German, \$58.35@\$54, c.i.f. Atlantic seaports. Other quotations unchanged.

No quotable changes have taken place in the following ferro-alloys from the prices quoted in the Dec. 3 issue: Fer-

rotitanium, Ferrocerium, Ferromolybdenum, Ferrosilicon, Ferrotungsten, Ferro-Uranium, and Ferrovanadium.

Metal Products

Copper Sheets—Current New York list price, 21.25c. per lb.; wire, 15@15.25c.

Yellow Metal—Dimension sheets, 17.75c.; sheathing, 16.25c.; rods ½ to 3 in., 14.75c.

Zinc Sheets—\$8.50 per 100 lb. less 8 per cent on carload lots, f.o.b. works.

Lead Sheets and Nickel Silver, unchanged from Dec. 3 quotations.

Refractories

Chrome Brick—\$43@\$45 per net ton.

Fire Brick—First quality, 9-in. shapes, \$28 per 1,000, Pennsylvania, Ohio, and Kentucky.

Magnesite Brick—9 in. straights, \$52 @\$55 per net ton, f.o.b. works.

Silica Brick—9 in., per 1,000, \$28 @\$40 in carload lots, f.o.b. shipping points.

Prices on the following are unchanged from the figures published in the Dec. 3 issue: Bauxite Brick, Chrome Cement.

The Iron Trade

Pittsburgh, Dec. 27, 1921

The Steel Corporation's reduction in its prices of tubular goods of \$5 to \$6 a ton on Dec. 15, was followed on Dec. 21 by a reduction in wire products to \$5 a ton under the prices ruling before the advance of Sept. 12, which held for a while and then slipped away. In the cases of both tubular goods and wire products the reductions were made on account of shading by independent producers. New prices are 2.25c. for plain wire, 2.50c. for nails, and 3.15c. for galvanized barb wire.

The finished steel markets generally have been quiet in the past week, as is invariably the case at this holiday time. Buying is likely to increase gradually during January, substantially restoring the degree of activity that has prevailed in the past few months.

Steel prices are likely to remain practically stationary while general conditions remain as at present. Should buyers show a disposition to take hold in a free manner, particularly if they are willing to contract for forward deliveries, competition would probably carry prices down a trifle farther, but only by a very few dollars a ton. A thorough liquidation has already occurred.

Pig Iron—The quietness that has prevailed in the market for three months past is natural at this time of the year. Old contracts are now well worked out and buyers have extremely small stocks, so that a moderate volume of buying is to be expected in January. The market is quotable at \$20 for bessemer, \$19 for basic and \$19.50@\$20 for foundry, Valley, freight to Pittsburgh being \$1.96.

Coke

Connellsville—Furnace, \$3.35@\$3.50 foundry, \$4.25@\$4.75 per ton.

Anaconda Copper Shares as an Investment

By HARRY J. WOLF

Written for *Engineering and Mining Journal*

IN A RECENT DISCUSSION of the copper situation from the investor's viewpoint (*Engineering and Mining Journal*, Oct. 22, 1921), attention was called to the fact that most of the large copper mining companies were shut down, were temporarily maintaining their properties at a loss, and were not paying dividends, so that commitments in their shares could not be called investments according to the strict definition of the term. However, it was pointed out that a logical interpretation of current industrial developments indicated that numerous copper mining companies, now idle, would certainly resume operations in due time, and again earn profits and pay dividends. Consequently, the purchase of their shares, although speculative according to the technical meaning of the word, could be regarded with assurance as "investment for profit."

One of the best examples of this type of mining company is Anaconda, whose stock is frequently referred to as our premier mining security, on account of its established earning ability, and its consequent popularity among investors and speculators. There are good reasons for this popularity, as all consistent readers of the *Engineering and Mining Journal* must know. Well-informed mining men are aware that Anaconda is a powerful, successful, and progressive corporation, with a broad charter, an able operating staff, and a most efficient technical organization.

In its numerous mines, Anaconda maintains large reserves of ore of all grades, and recent deep-level development has opened strong veins of high-grade copper ore at a depth several hundred feet below any of its other underground workings. These discoveries indicate the downward extension of some of the company's best veins, and justify reasonable expectation of the availability of an immense tonnage of payable ore throughout extensive vein areas for future exploitation.

Anaconda is the greatest copper producing company in the world, having produced during recent years one-third of the copper output of the United States, and one-sixth of the world's production. Its metal production is not limited to copper, for it is also one of the greatest silver producers. Its output of gold is substantial, and during certain months prior to its shut-down it produced more zinc than copper.

It operates its own great metallurgical plants at Anaconda and Great Falls, Montana, and controls numerous important and successful subsidiaries. It is developing and equipping large copper properties in Chile, and these will eventually become heavy producers of low-cost copper.

The company's interests are rapidly becoming more diversified, and it is steadily advancing its power in the manufacturing field by increasing the number of its finished products. Its electrolytic zinc commands a premium over the market price for ordinary brands of the metal. Its copper rod and wire mill at Great Falls is the most modern and efficient plant of its kind in the United States, and its wire can find a profitable market from Pennsylvania to California.

In connection with its metallurgical operations it recovers or manufactures numerous byproducts at a substantial profit, including sulphuric acid, arsenic, and the highest quality of white lead. It has produced ferromanganese at a profit, and may develop an important industry in this alloy whenever market conditions therefor will permit. Last year it completed an initial plant for the manufacture of fertilizer having about three times the strength of any fertilizer produced elsewhere, and this new product will in all probability be marketable at a profit as far east as Indiana, and possibly Ohio. Anaconda's fertilizer industry

bids fair to expand into one of great importance and permanence.

The Anaconda Copper Mining Co. was incorporated in 1895, as successor to the Anaconda Mining Co., with a charter of forty years duration. In 1910 its capital stock was increased from 1,200,000 shares to 6,000,000 shares, of a par value of \$25, for the purpose of acquiring properties of other mining companies operating in the Butte district. Under this plan it acquired, in exchange for its stock, the property and assets of the Boston & Montana Consolidated Copper & Silver Mining Co., Red Metal Mining Co., Washoe Copper Co., Butte & Boston Consolidated Mining Co., Big Blackfoot Lumber Co., Trenton Mining & Development Co., Parrot Silver & Copper Co., Alice Gold & Silver Mining Co., and Diamond Coal & Coke Co. During the same year it acquired from the Amalgamated Copper Co., in exchange for stock, the Original Consolidated Mining Co., Colusa-Parrot Mining & Smelting Co., and the Clark Montana Realty Co.

In 1914 Anaconda purchased the assets of the International Smelting & Refining Co., which in turn owned the entire capital stock of the Tooele Valley Railway Co., International Lead Refining Co., and Raritan Copper Works. In 1915 the Amalgamated Copper Co. was absorbed through an exchange of stock. In 1916 it purchased the Pilot Butte Mining Co.

At the present time, the Anaconda Copper Mining Co. controls, directly or indirectly, the Butte, Anaconda & Pacific Railway, International Lead Refining Co., International Smelting Co., Mountain Trading Co., Raritan Copper Works, Raritan Terminal & Transportation Co., Tooele Valley Railway Co., United Metals Selling Co., Diamond Coal & Coke Co., Anaconda Lead Products Co., Andes Copper Co., Andes Copper Mining Co., Potrerillos Railway Co., Santiago Mining Co., and Walker Mining Co. Its importance and power as a holding company is further illustrated by the fact that on December 31, 1920, it owned 285,300 shares of Inspiration Consolidated Copper Co., 59,600 shares of Greene Cananea Copper Co., 217,040 shares of Butte Copper & Zinc Co., and half the stock of the Arizona Oil Co., the other half being owned by Inspiration.

Enough has been said to show the importance and scope of the company's operations. From the standpoint of investment or speculation it is necessary also to inquire into its capitalization and financial condition. On July 25, 1915, the par value of the company's stock was changed from \$25 to \$50. The authorized capitalization is \$150,000,000, of which \$116,562,500, represented by 2,331,250 common shares, is outstanding. Ahead of this stock there is funded debt to the amount of \$50,000,000, in the form of 10-year, secured gold bonds, due Jan. 1, 1929, half of which bear 6 per cent and the other half 7 per cent interest. These bonds are a direct obligation of the company, but not secured by a mortgage. They are secured by pledge of stocks of constituent companies valued in excess of \$100,000,000. An additional obligation is the company's guarantee of 12.26 per cent principal and interest, of \$40,000,000 Copper Export Association 8 per cent notes.

According to the balance sheet as of Dec. 31, 1920, the total assets were valued at \$294,795,732, of which \$85,436,160 represented current assets. The current liabilities were \$17,574,860, thus leaving net working capital at \$67,861,300., as compared to \$44,377,202 in 1919 and \$9,759,376 in 1914. The profit and loss surplus was \$84,753,462. Net assets behind the common stock amounted to \$201,315,962, or \$86.36 a share.

Anaconda's earning ability is illustrated in the following figures from the income account for the past eight years:

Year	Operating Revenue	Net Income	Dividends	Earned Per Share	Paid Per Share
1913	\$44,433,856	\$11,323,499	\$12,997,500	\$2.61	\$3.00
1914	37,130,550	8,789,588	9,077,500	1.88	2.00
1915	68,256,381	16,695,807	9,325,000	7.16	4.00
1916	110,964,242	37,941,834	17,484,375	21.80	7.50
1917	123,238,568	37,721,188	19,815,625	14.73	8.50
1918	123,753,535	26,907,055	17,484,375	8.92	7.50
1919	72,008,124	8,031,879	9,325,000	2.19	4.00
1920	67,758,984	6,992,010	6,993,750	1.15	3.00

The last dividend disbursement was made in November, 1920, when \$1 a share was paid. During the copper boom of 1916, the shares sold up to 105½, and within a period of about four months dropped to a little above 70 during February, 1917. After rising to 87 in May, 1917, they fell to 51½ during November of the same year. The shares then went up to 74½ in October, 1918, down as low as 54½ in February, 1919, up to 77½ in July, 1919, and then steadily downward to 30 in December, 1920. Since the extreme low, following the passing of the dividend for the first time since 1896, the shares have worked up and down between 43½ and 31½. During this period the stock has been accumulated by investors and speculators who were confident that sooner or later the market price must begin to discount the period of prosperity towards which the copper industry was surely advancing, in view of the decrease in unsold stocks of metal, and the gradual improvement in demand. On October 19, 1921, the shares began a steady advance from 38½ to 50, which was reached on December 15. At any price below 50, the shares would yield over 10 per cent with a \$5 dividend, or over 8 per cent with a \$4 dividend. During the past six weeks the shares have been in the process of advancing, after a period of accumulation extending over about ten months. Under such circumstances the stock will be purchased by "investors for profit," who desire to profit from the discounting of future more favorable conditions, and who are willing to await future dividends with patience; and also by the large army of speculators and traders who ignore dividends for the most part, but who are very much alive to the discounting process referred to, and the accompanying rallies and reactions due to the usually-present lack of balance between supply and demand for the shares. The proposed merger with the American Brass Co. has also stimulated interest in the stock. This merger will be a definite step in advance in the marketing of copper and its possibilities are great. The financial details of the transaction have received wide publicity recently in the press. Anaconda will offer 223,125 unissued shares to present stockholders to provide additional cash required to

pay American Brass shareholders for such of their holdings as will be required under Anaconda's offer to purchase.

From almost any angle, interest in Anaconda shares appears to be justified at this time, especially in view of the possibility that the company may resume operating and be running as usual before the middle of 1922.

Ontario's Metal Production for First Nine Months of 1921

Returns received by the Ontario Department of Mines from the metalliferous mines, smelters, and refining works of the province for the nine months ending Sept. 30, 1921, are tabulated below, and for purposes of comparison the quantities and values are given for the corresponding period in 1920. Tons throughout are short tons of 2,000 lb.

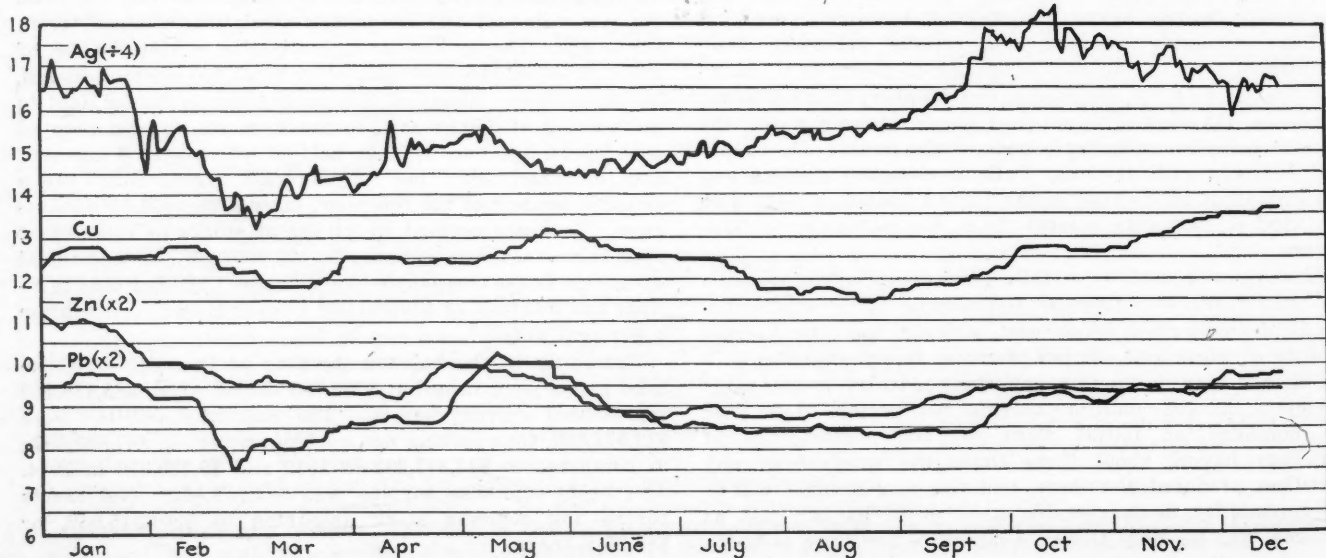
ONTARIO'S METALLIFEROUS PRODUCTION, FIRST NINE MONTHS 1921

Product	Quantity		Value	
	1920	1921	1920	1921
Gold, oz.	424,297	474,956	\$8,735,768	\$9,818,073
Silver, oz.	7,831,143	6,586,910	8,435,088	4,382,520
Platinum metals, oz.	214	915	13,917	41,060
Nickel (metallic), lb.	7,060,078	4,521,407	2,440,303	1,542,607
Nickel oxide, lb.	4,886,712	975,310	1,146,768	197,812
Other nickel compounds, lb.	159,725	169,885	15,362	15,936
Nickel in matte exported tons (a)	17,446	2,908	8,723,000	1,454,000
Cobalt (metallic), lb.	159,151	30,564	373,168	91,786
Cobalt oxide, lb.	509,043	162,364	1,015,696	330,914
Other cobalt compounds, lb.	1,717	.....	1,629	.....
Cobalt-nickel oxides and residues, lb.	.....	366,581	.....	116,948
Lead, pig, lb.	1,290,726	2,539,551	117,122	134,871
Copper sulphate, lb.	98,918	99,553	4,946	5,973
Copper (metallic) lb.	4,853,495	2,926,407	795,423	330,084
Copper in matte exported tons (a)	9,497	2,886	2,659,160	451,760
Iron ore, tons (b)	5,468	22	47,120	99
Iron pig, tons (c)	49,422	82,318	1,395,948	2,079,729
Tons.....	.....	.....	\$35,920,418	\$20,994,172

(a) Copper in matte was valued at 14c. per lb. in 1920, 8c. in 1921, and nickel in matte at 25c. per lb. in both years. Total matte produced was 17,013 tons, of which 7,011 tons was exported.
 (b) Shipments of iron ore totaled 27,775 short tons, valued at \$119,262. The figures in the table cover shipments to points other than Ontario blast furnaces.
 (c) Total output of pig iron from both domestic and imported ore was 393,303 tons, worth \$9,936,597. Figures in the table represent proportional product from Ontario ore.

The outstanding feature in connection with Ontario's metalliferous production is the growing importance of her gold-mining industry. Provided the output for the last quarter of the year equals that of the third quarter, Ontario's gold production for the full year 1921 will be approximately \$13,870,000, and, with the premium added, \$15,870,000. Fortunately the success or failure of Ontario's gold industry does not depend on the exchange premium.

1921 Prices of New York Copper, Silver and Lead and St. Louis Zinc



COMPANY REPORTS

Tonopah Mining Co. Has Profitable Year

A report of operations of the Tonopah Mining Co. of Nevada for the year ended Dec. 31, 1920, states that 56,587 dry tons of ore was produced, averaging 0.142 oz. of gold and 13.21 oz. of silver, value \$16.93 per ton, on which a profit of \$238,822.92 was made. There was also treated 6,979 tons of dump ore of an average content of 0.065 oz. of gold and 6.40 oz. of silver, valued at \$7.83, on which a profit of \$13,449.14 was made. Income and surplus account follows:

Surplus Dec. 31, 1919.....	\$4,381,247.11	
Deduct:		
Interest due from subsidiary companies, previously credited to surplus but not as yet collected.....	\$73,475.47	
Portion of dividend received from Tonopah Placers Co. in 1916, withdrawn from surplus and applied to reduction of value of stock held.....	40,000.00	
	\$113,475.47	
Less amount charged into operations in 1919 for Internal Revenue Tax, not used, restored to surplus.....	30,000.00	83,475.47
		\$4,297,771.64
Net earnings and income for 1920.....	\$410,399.92	
Dividend paid. No. 56, Oct. 21, 1920, 5 per cent.....	50,000.00	
		360,399.92
Net increase in surplus.....		\$4,658,171.56
Charges against profit and loss account:		
Additional reserve for depreciation on bonds in treasury.....		16,039.95
Surplus, Dec. 31, 1920.....		\$4,642,131.61

Receipts and disbursements follow:

RECEIPTS

American Smelters Securities Co., mill products.....	\$237,164.60
U. S. Mint, mill products.....	529,825.68
Tonopah Belmont Development Co., ore shipped.....	46,970.61
Commercial Bank of Spanish America, sale of silver bullion.....	42,062.83
Interest on bank balances.....	891.56
Interest on loans and investments.....	85,301.60
Dividend, Tonopah & Goldfield R.R. Co.....	89,047.00
Dividend, Esmeralda Power Co.....	10,875.00
Dividend, Tonopah Banking Corporation.....	120.00
Real estate rentals.....	2,066.55
Administration expense from subsidiary companies.....	30,000.00
Demand loans from bank.....	25,000.00
Loans from subsidiary companies.....	159,951.58
Demand loans returned.....	210,000.00
Sale of \$82,850 United States First Liberty Loan 3½ per cent bonds.....	80,877.60
Draft in transit, end of year 1920.....	10,000.00
Accounts collected.....	17,275.65
Total receipts.....	\$1,577,430.26
Cash on hand Jan. 1, 1920.....	18,588.97
	\$1,596,019.23

DISBURSEMENTS

Labor, supplies, freight, salaries and general expense.....	\$616,688.85
Power purchased.....	49,434.01
Industrial insurance.....	12,495.38
Fire insurance.....	8,241.68
Taxes paid.....	15,978.57
Exploration expense.....	13,504.71
Demand loans paid.....	52,000.00
Loans to subsidiary companies.....	28,083.85
Loans on demand.....	356,000.00
Securities purchased.....	271,703.76
Sundry investments.....	10,756.96
Custom ore purchased.....	74,667.91
Dividend No. 56, 5 per cent.....	50,000.00
Total disbursements.....	\$1,560,455.68
Cash on hand Dec. 31, 1920.....	\$35,563.55

Mining costs for 1920 were \$5.945 per ton, compared with \$6.370 for 1919. Milling costs were \$4.077 per ton in 1920.

The company is capitalized at \$1,000,000, with shares of \$1 par value.

Broken and unbroken ore is in sight to maintain a production of 150 tons per day for about four months.

Tonopah Placers Co.

A report of operations of the Tonopah Placers Co., a subsidiary of the Tonopah Mining Co. of Nevada, for 1920, states that Dredge No. 1 continued operating during the year on the Magnum Bonum Placer. This dredge handled 1,340,876 cu.yd. of material during the year, giving a total production of \$169,121.57, or an average value of 12.6c. per yd., with a net operating profit of \$66,280.15, or 5c. per cu.yd. It is probable that this dredge will have about four or five years more operation. During 1920 the company acquired a parcel of the Magnum Bonum Placer and the Rankin Placer, adding about twenty-seven acres of available dredging ground for this dredge. The operation of No. 2 dredge was suspended in December of 1919 and continued closed down during all of 1920. Dredge No. 3 operated during 1920 upon ground leased from the Long Island Mining Co. Its operation was suspended in the early part of December, 1920. Income statement follows:

Surplus, Dec. 31, 1919.....		\$99,295.99
Deduct cost of leasehold right to dredge property of Long Island Mining Co., chargeable to net income for 1919.....		10,000.00
		\$89,295.99
Net earnings and income for year 1920		
Gross value of bullion shipped to mint.....	\$233,661.96	
Cost of operations.....	181,007.61	
		\$52,654.35
Other income		
Earnings from electric lighting plant.....	\$792.23	
Interest on bank balances.....	391.15	
Interest on Liberty Bonds.....	237.50	
Rental of company cottages.....	402.61	
Miscellaneous.....	1,505.22	
	\$3,328.71	
Net income for year 1920.....		\$55,983.06
Charges against profit and loss account		\$145,279.05
Reserve for depletion, 10 per cent on cost of property and 10 per cent on plant and equipment for year 1920.....		177,484.39
Excess of depletion for 1920, over surplus, written off against capital stock.....		\$32,205.34
Cubic yards dredged.....		1,791,143
Gold produced, ounces.....		11,008.96
Silver produced, ounces.....		3,026.27
Value per yard.....		\$0.13

Capital stock authorized and issued amounts to \$1,000,000, of which the Tonopah Mining Co. of Nevada owns 83½ per cent.

Mandy Mining Co.

A report of operation of Mandy Mining Co., a subsidiary of the Tonopah Mining Co., of Nevada, for 1920, states that mine operations were suspended in March, 1919, as all of the high-grade ore had been taken out at that time and stored at Sturgeon Lake. Income statement follows:

Surplus, Dec. 31, 1919.....		\$168,317.96
Less adjustment for the year 1919		
Additional income tax paid.....	\$4,932.51	
Ore settlements with smelters.....	50,028.31	54,960.82
		\$113,357.14
Net earnings and income for year 1920		
Gross value of 7,510 dry tons ore shipped to smelter.....	\$417,156.79	
Interest on bank balance.....	807.26	
Interest on Canadian bonds.....	19,012.81	
Sale of equipment.....	22,193.00	
Miscellaneous.....	1,044.23	
	\$460,214.09	
Cost of operations		
Freight and treatment.....	\$116,858.49	
Transportation.....	51,334.36	
Interest on loans.....	17,156.50	
Estimated income taxes.....	10,000.00	
General expense.....	21,733.47	217,082.82
Net income for year 1920.....		\$243,131.27
Charges against profit and loss account		\$356,488.44
Depletion: 60 per cent of \$100,000 original cost of mining property.....	\$60,000.00	
Depreciation on boats and barges.....	7,383.22	67,383.22
Surplus, Dec. 31, 1920.....		\$289,105.19

ENGINEERING AND MINING JOURNAL

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AN UNUSUALLY COMPLETE DESCRIPTION of this mill, recently erected by the American Smelters Securities Co. under the direction of David Cole. Details are given of method of estimating tonnages, water elevator, and motor requirements; also of much of the construction. Process includes crushing, grinding, classifying and tabling.	Company Reports 1079
<i>Engineering and Mining Journal</i> , December 31, 1921.	Stocks 1080
Mountain of Sulphur in Pacific 1057	
Maine Molybdenum Tested 1057	
The Permian Revolution in North America 1058	
BY J. R. FINLAY.	
AN IMPORTANT GEOLOGICAL EVENT which produced great climatic, geographic, and geologic changes in North America. Its study gives a good perspective on ore deposition in the southwest.	
<i>Engineering and Mining Journal</i> , December 31, 1921.	
Searchlight Section 18	What and Where To Buy 36
Directory of Engineers 32	Advertising Index 42

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CIRCULATION OF THIS ISSUE, 9,215 COPIES

MINING STOCKS

Week Ended December 24, 1921

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Ahmeek.....	Boston	60½	58½	58½	Sept. '20, Q \$0.50
Alaska-Br. Col. new.	N. Y. Curb	2½	2½	2½	.....
Allouez.....	Boston	24	22½	23	Mar. '19 1.00
Anaconda.....	New York	49½	47½	49½	Nov. '20, Q 1.00
Aradian Consol.....	Boston	3½	3	3	.....
Ariz. Com'l.....	Boston	9	9	9	Oct. '18, Q .50
Big Ledge.....	N. Y. Curb	*29	*26	*28	.....
Bingham Mines.....	Boston	13	12½	12½	Sept. '19, Q .25
Calumet & Arizona..	Boston	.....	.....	58	Dec. '21 Q .50
Calumet & Hecla.....	Boston	280	269	269	June '20, Q 5.00
Canada Copper.....	N. Y. Curb	*37	*35	*37	.....
Centennial.....	Boston	10	10	10	Dec. '18, SA 1.00
Cerro de Pasco.....	New York	35½	33½	34½	Mar. '21, Q .50
Chile Copper.....	New York	16	14½	15½	.....
Chino.....	New York	28	26½	28	Sept. '20, Q .37½
Columbus Rexall ..	Salt Lake	*11½	*10½	*11½	.....
Con. Arizona.....	N. Y. Curb	*4	*4	*4	Dec. '18, Q .05
Con. Copper Mines..	N. Y. Curb	1½	1½	1½	.....
Copper Range.....	Boston	40	37½	37½	Sept. '20, Q .50
Crystal Copper.....	Boston Curb	*56	*53	*56	.....
Davis-Daly.....	Boston	6½	6½	6½	Mar. '20, Q .25
East Butte.....	Boston	11½	10	10	Dec. '19, A .50
First National.....	Boston Curb	*85	*75	*75	Feb. '19, SA .15
Franklin.....	Boston	2	1½	1½	.....
Gadsden Copper....	Boston Curb	†*50	†*40	*49	.....
Granby Consol.....	New York	28	25½	28	May '19, Q 1.25
Greene-Caranea....	New York	28	27	27½	Nov. '20, Q .50
Hancock.....	Boston	3	3	3	.....
Howe Sound.....	N. Y. Curb	2½	2½	2½	Jan. '21, Q .05
Inspiration Consol..	New York	41½	37½	40	Oct. '20, Q 1.00
Iron Cap.....	Boston Curb	8	7½	7½	Sept. '20, K .25
Isle Royale.....	Boston	23	23	23	Sept. '19, SA .50
Kennecott.....	New York	26½	24½	26½	Dec. '20, Q .50
Keweenaw.....	Boston	1½	1½	1½	.....
Lake Copper.....	Boston	2½	2½	2½	.....
La Salle.....	Boston	†2½	†1½	2	.....
Magma Chief.....	N. Y. Curb	.....	.....	*8	.....
Magma Copper.....	N. Y. Curb	25½	23	25½	Jan. '19, Q .50
Majestic.....	Boston Curb	.....	.....	*5	.....
Mason Valley.....	Boston	1½	1½	1½	.....
Mass Consolidated..	Boston	2½	2½	2½	Nov. '17, Q 1.00
Miami Copper.....	New York	27½	25½	26½	Nov. '21, Q .50
Michigan.....	Boston	2½	2	2	.....
Mohawk.....	Boston	58	54	55	Nov. '20, Q 1.00
Mother Lode Coa....	N. Y. Curb	5½	5½	5½	.....
Nevada Consol.....	New York	15½	14½	15	Sept. '20, Q .25
New Cornelia.....	Boston	18½	16½	16½	Aug. '20, K .25
North Butte.....	Boston	13½	12	12½	Oct. '18, Q .25
North Lake.....	Boston	†*40	†*20	*24	.....
Ohio Copper.....	N. Y. Curb	*11	*11	*11	.....
Old Dominion.....	Boston	25	23	23	Dec. '18, Q 1.00
Osceola.....	Boston	34½	32½	32½	June '20, Q .50
Phelps Dodge.....	Open Mar.	†185	†175	.....	Oct. '21, Q 1.00
Quincy.....	Boston	45½	41½	41½	Mar. '20, Q 1.00
Ray Consolidated....	New York	15½	14½	15	Dec. '20, Q .25
Ray Hercules.....	N. Y. Curb	*18	*15	*15	.....
St. Mary's Min. Ld..	Boston	44½	42	44	Dec. '21, K 1.00
Seneca Copper.....	Boston	.....	.....	24½	.....
Shannon.....	Boston	1½	1	1	Nov. '17, Q .25
Shattuck Arizona....	New York	9	8½	8½	Jan. '20, Q .25
South Lake.....	Boston	†1	†*50	*60	.....
Superior & Boston..	Boston	1½	1½	1½	.....
Tenn. C. & C. cfs....	New York	10½	9½	10½	May '18, I 1.00
Tuolumne.....	Boston	*68	*60	*63	May '13 .10
United Verde Ex....	Boston Curb	30	28½	29	Nov. '21, Q .25
Utah Consol.....	Boston	1½	1½	1½	Sept. '18, .25
Utah Copper.....	New York	64	61	64	June '21 Q .50
Utah Metal & T.....	Boston	1½	1½	1½	Dec. '17, .30
Victoria.....	Boston	1½	1½	1½	.....
Winona.....	Boston	*50	*45	*45	.....
Wolverine.....	Boston	11½	10½	11	.....

NICKEL-COPPER					
Internat. Nickel....	New York	12½	11½	12½	Mar. '19, .50
Internat. Nickel, pf..	New York	69	69	69	Nov. '21, Q 1.50

LEAD					
National Lead.....	New York	84	83	83	Sept. '21, Q 1.50
National Lead, pfd..	New York	108½	108½	108½	Dec. '21, Q 1.75
St. Joseph Lead.....	New York	13	12½	12½	Dec. '21, Q .25

QUICKSILVER					
New Idria.....	Boston	2	1½	1½	.....

ZINC					
Am. Z. L. & S.....	New York	13½	12½	12½	May '20, 1.00
Am. Z. L. & S. pfd..	New York	39	37	37	Nov. '20, Q 1.50
Butte C. & Z.....	New York	5½	5½	5½	June '18, .50
Butte & Superior....	New York	21	17½	19½	Sept. '20, 1.25
Callahan Zn-Ld.....	New York	6½	5½	6	Dec. '20, Q .50
New Jersey Zn.....	N. Y. Curb	124½	123	124½	Nov. '21, Q 2.00
Yellow Pine.....	Los Angeles	††	.....	*45	Sept. '20, Q .03

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. †† Quotations missing.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

Stock	Exch.	High	Low	Last	Last Div.
GOLD					
Alaska Gold.....	New York	.....	.....	.....	.....
Alaska Juneau.....	New York	.....	.....	.....	.....
Carson Hill.....	New York	11½	11	11½	.....
Cresson Consol. G....	N. Y. Curb	2½	2½	2½	June '20, Q \$0.10
Dome Extension.....	Toronto	*69	*69	*69	.....
Dome Mines.....	New York	18½	18½	18½	Oct. '21, Q .25
Florence Goldfield..	N. Y. Curb	*30	*28	*30	.....
Golden Cycle.....	Colo. Springs	*71	*70	*70	June '21, Q .02
Goldfield Consol....	N. Y. Curb	*4	*3	*3	Dec. '19, .05
Hollinger Consol....	Toronto	7.79	7.75	7.76	Dec. '21, 4 wks. .05
Homestake Mining....	New York	53½	53½	53½	Nov. '21, M .25
Kirkland Lake.....	Toronto	*30	*24	*30	.....
Lake Shore.....	Toronto	1.27	1.20	1.27	Nov. '21, K .02
McIntyre-Porcupine..	Toronto	2.04	1.97	2.04	Sept. '21, K .05
Porcupine Porcupine..	Toronto	*12	*11	*12	July '17, .03
Porcupine Crown.....	Toronto	*18½	*17	*18	.....
Portland.....	Colo. Springs	*42	*41	*41	Oct. '20, Q .01
Schumacher.....	Toronto	*31½	*30	*31	.....
Silver Pick.....	N. Y. Curb	.....	.....	*50	.....
Teck Hughes.....	Toronto	*15½	*15	*15½	.....
Tom Reed.....	Los Angeles	††	.....	*40	Dec. '19, .02
United Eastern.....	N. Y. Curb	2½	2½	2½	Oct. '21, Q .15
Vindicator Consol....	Colo. Springs	*21	*20½	*21	Jan. '20, Q .01
White Caps Mining..	N. Y. Curb	.....	.....	*4	.....
Yukon Gold.....	N. Y. Curb	1½	1½	1½	June '18, .02½

SILVER					
Batopilas Mining....	New York	.....	.....	.....	Dec. '07, I .12½
Beaver Consol.....	Toronto	†*22½	*19½	*19½	May '20, K .03
Coniagas.....	Toronto	1.50	1.30	1.50	May '21, Q .12½
Crown Reserve.....	Toronto	*10	*8½	*10	Jan. '17, .05
Kerr Lake.....	N. Y. Curb	3½	3½	3½	Oct. '21, Q .12½
La Rose.....	Toronto	*34	*32	*33½	Apr. '18, .02
McKinley-Dar-Sav...	Toronto	*17	*14	*17	Oct. '20, Q .03
Mining Corp. Can....	Toronto	1.10	1.00	1.10	Sept. '20, Q .12½
Nipissing.....	N. Y. Curb	7½	6½	7	Oct. '21, Q .03
Ontario Silver.....	New York	3½	2½	3	Jan. '19, Q .50
Ophir Silver.....	N. Y. Curb	.....	.....	*12	Jan. '12, .10
Temiskaming.....	Toronto	*27	*25	*26	Jan. '20, K .04
Trethewey.....	Toronto	*9½	*9	*9½	Jan. '19, .05

GOLD AND SILVER					
Boston & Montana..	N. Y. Curb	*1½	*88	*91	.....
Cash Boy.....	N. Y. Curb	*6	*4	*5	.....
Dolores Esperanza...	N. Y. Curb	1½	*75	1	.....
El Salvador.....	N. Y. Curb	*7	*6	*6	.....
Jim Butler.....	N. Y. Curb	.....	.....	*7	Aug. '18, SA .07
Jumbo Extension....	N. Y. Curb	*2	*1	*2	June '16, .05
Louisiana Con.....	N. Y. Curb	.....	.....	.....	.....
MacNamara M. & M.	N. Y. Curb	*10	*9	*10	May '10, .02½
Tonopah-Belmont....	N. Y. Curb	1½	1½	1½	Apr. '21, Q .05
Tonopah-Divide.....	N. Y. Curb	*64	*56	*64	.....
Tonopah-Extension..	N. Y. Curb	1½	1½	1½	Oct. '21, Q .05
Tonopah Mining.....	N. Y. Curb	1½	1½	1½	Oct. '21, SA .05
West End Consol....	N. Y. Curb	*83	*75	*80	Dec. '19, SA .05

SILVER-LEAD					
Caledonia.....	N. Y. Curb	*6	*6	*6	Jan. '21, M .01
Cardiff M. & M.....	Salt Lake	†*95	†*87	*92	Dec. '20, .15
Chief Consol.....	Boston Curb	3	3	3	Aug. '21, Q .05
Consol. M. & S.....	Montreal	19	18	18	Oct. '20, Q .62½
Daly Mining.....	Salt Lake	†3.00	†1.15	.....	July '20, Q .10
Daly-West.....	Boston	2	1½	.....	Dec. '20, Q .10
Eagle & Blue Bell..	Boston Curb	†3	†2½	2½	Apr. '21, K .25
Electric Point.....	Spokane	*4	*3½	*4	May '20, SA .03
Federal M. & S.....	New York	12	10	10	Jan. '09, 1.50
Federal M. & S., pfd	New York	42½	36½	38	Dec. '21, Q 1.00
Florence Silver.....	Spokane	*19	*18	*19	Apr. '19, .01½
Grand Central.....	Salt Lake	*41	*40	*41	Jan. '21, K .01
Hecla Mining.....	N. Y. Curb	4½	4½	4½	Sept. '21, Q .10
Iron Blossom Con....	N. Y. Curb	*40	*25	*40	Apr. '20, Q .02½
Judge M. & S.....	Salt Lake	†3.00	†2.00	2.50	Sept. '20, Q .12½
Marsh Mines.....	N. Y. Curb	*4	*3	*3	June '21, I .02
Prince Consol.....	Salt Lake	*7	*5½	*7	Nov. '17, .02½
Rambler-Cariboo....	Spokane	*4	*3½	*4	Feb. '19, .01
Rex Consol.....	N. Y. Curb	*8	*7	*7	.....
South Hecla.....	Salt Lake	.....	.....	†*12½	Sept. '19, K .15
Standard Silver-Ld..	N. Y. Curb	*10	*10	*10	Oct. '17, .05
Stewart Mining.....	N. Y. Curb	*3	*3	*3	Dec. '15, .05
Tamarack-Custer....	Spokane	2.25	2.15	2.25	Jan. '21, Q .04
Tintic Standard....	Salt Lake	1.87½	1.77½	1.85	July '21, Q .05
Utah Apex.....	Boston	3	2½	2½	Nov. '20, K .25
Wilbert Mining.....	N. Y. Curb	.....	.....	*1	Nov. '17, .01

VANADIUM					
Vanadium Corp.....	New York	32½	31	31½	Jan. '21, Q 1.00

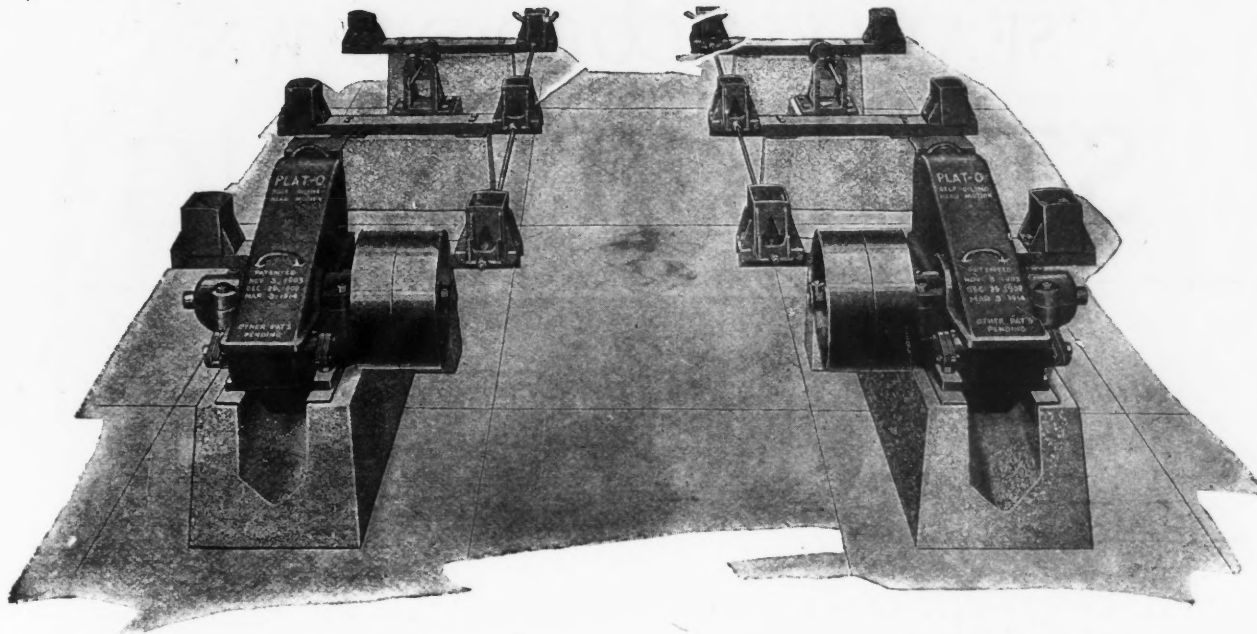
ASBESTOS					
Asbestos Corp.....	Montreal	53	50	52	Oct. '21, Q 1.50
Asbestos Corp., pfd..	Montreal	77	76	77	Oct. '21, Q 1.75

SULPHUR					
Freeport Texas.....	New York	15½	13½	14½	Nov. '19, Q 1.00
Texas Gulf.....	New York	41½	34½	41	Dec. '21, Q 1.00

MINING, SMELTING AND REFINING					
Amer. Sm. & Ref....	New York	45½	42½	45	Mar. '21, Q 1.00
Amer. Sm. & Ref. pf	New York	88½	87	87	Dec. '21, Q 1.75
Am. Sm. pf. A.....					

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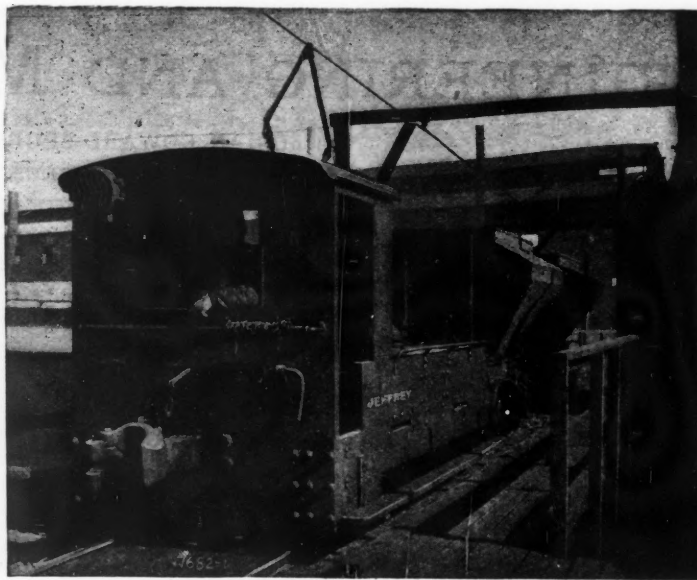
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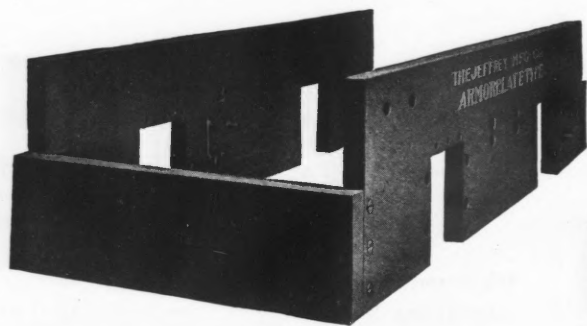
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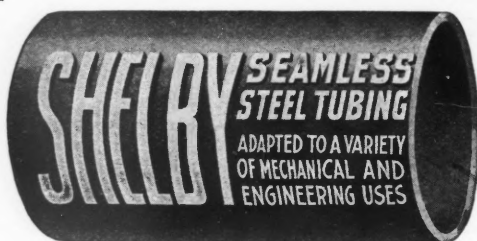
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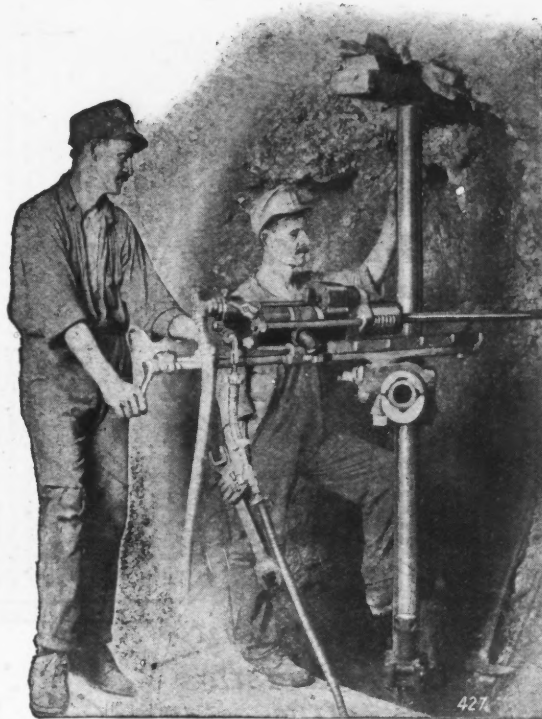


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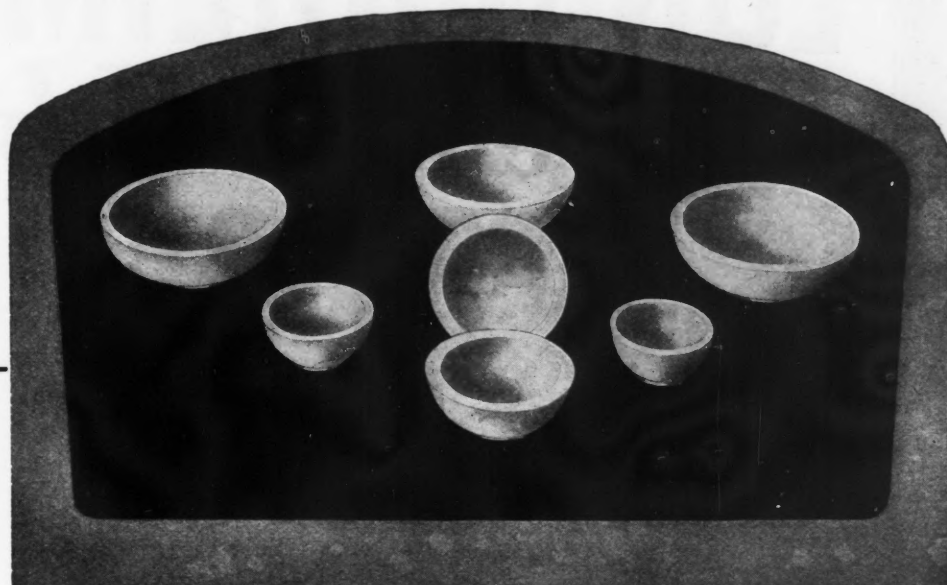
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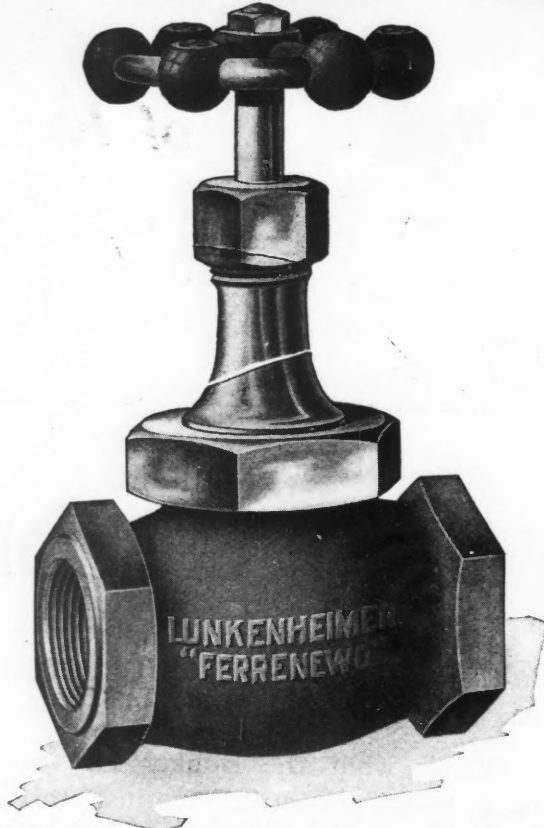
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Widener Building, Philadelphia



Just a Handful for the Night Express

This view was taken as the Phillie Gear Belt Line Truck was backing up to the shipping room door. It shows a portion of a day's output that is going by express.

There is not a gear in this lot that is overdue and the majority of them are from 48 to 72 hours ahead of schedule.

This gives a pretty fair idea of our plant range, but you ought to see some of the big fellows on the floors below.

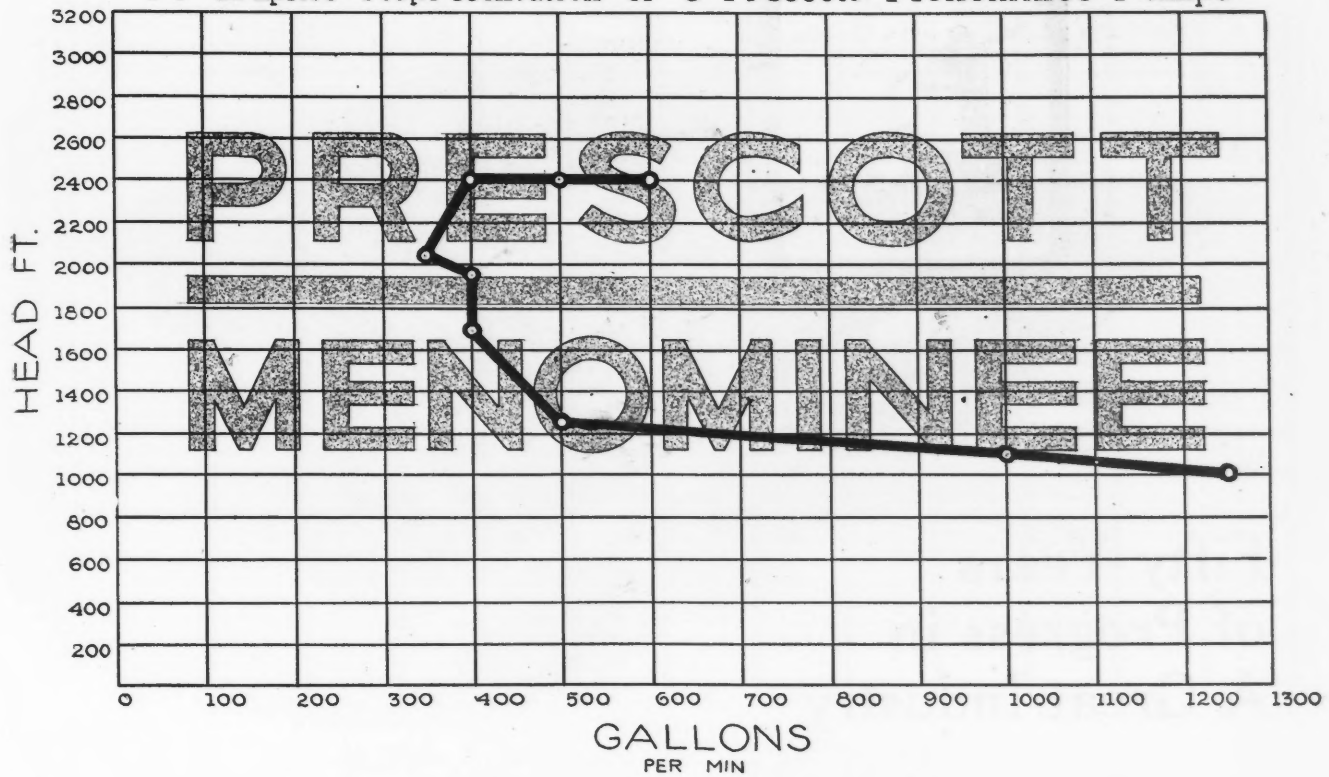
Our special service, however, applies to all gears. On many we can ship within 24 hours—on all we can meet your most urgent needs.

We save you the hours that mean dollars on every break-down job.

**The *Phillie Gear Book* is a valuable gear treatise.
Your copy is ready.**



A Graphic Representation of 9 Prescott-Menominee Pumps



The Pump that Made the Single Lift Practical

With a Prescott installation all the pumping equipment is in *one place*.

And, all water entering the suction pipes goes direct to the surface; there's no shambling or relaying with its inconvenience and unnecessary expense.

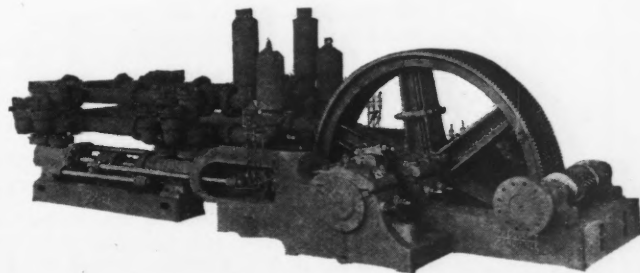
There are Prescott-Menominee Pumps that are throwing 3000 gallon per minute, others operating against 2400 foot heads.

All Prescott installations are operating efficiently and economically—and doing the work *in one lift*.

We specialize in Electric Pumps for deep mines and would welcome an opportunity to discuss your pumping problems with you.

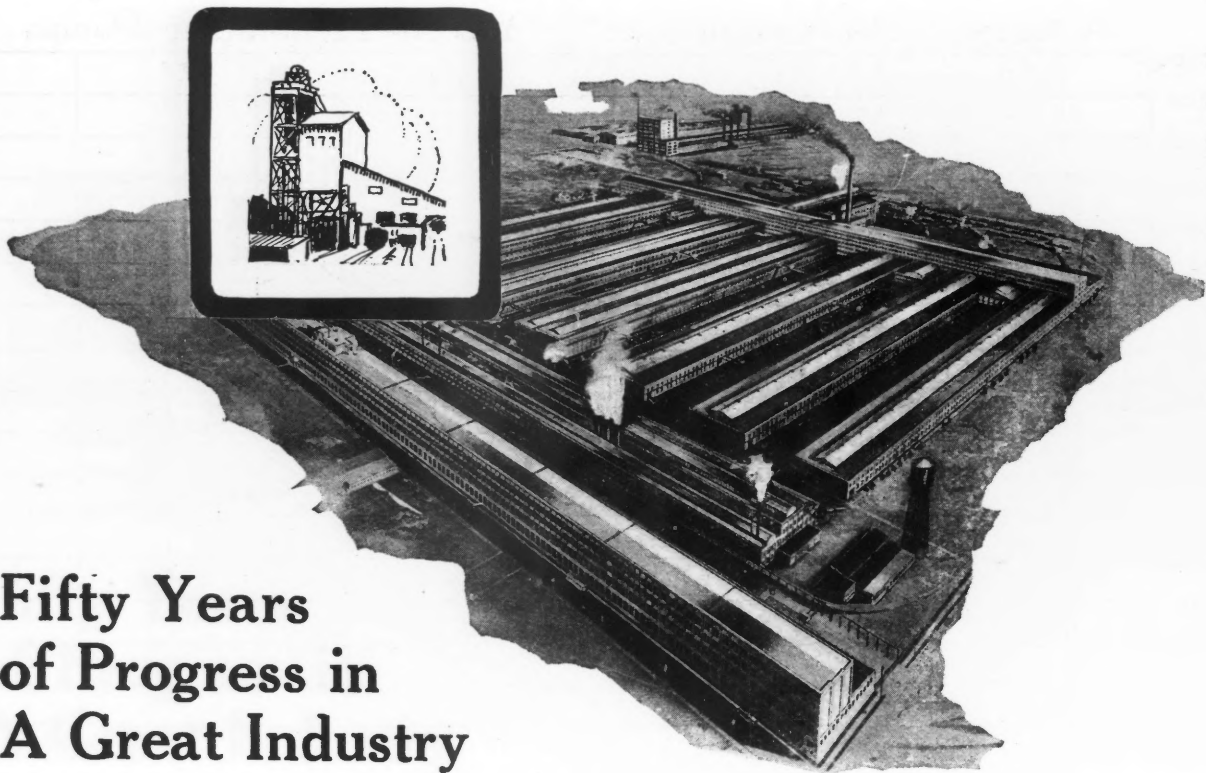


Company	Gal. per Min.	Ft. of Head
McKinney Steel Co.....	1250	1000
Cleveland-Cliffs Iron Co.	1000	1100
Montreal Mining Co. (two)....	500	1250
Oliver Iron Mining Co. (three)...	400	1700
Newport Mining Co.	400	1950
McKinney Steel Co.....	350	2050
Cleveland-Cliffs Iron Co. (two)	500	2400
U.S. Steel Corporation (three)...	400	2400
Steel & Tube Company of America..	600	2400



THE PRESCOTT COMPANY

FRED. M. PRESCOTT, President
Menominee, Michigan



Fifty Years of Progress in A Great Industry

ALLIS-CHALMERS MANUFACTURING COMPANY and its predecessors have been identified with the development of mechanical equipment used in connection with mining and metallurgical operations during the past fifty years.

This period covers the development of the precious metal mining industry in the United States, as well as the metallurgical processes connected therewith from its infancy. Prior to the discovery of gold in California, in 1849, very little gold, silver, copper, zinc or lead was produced in the United States.

There was some gold mining—both placer and quartz—in Georgia and the Carolinas, and lead was mined in Illinois, but the methods employed in the mining and reduction of ore were based on European practice and compared with present day methods were crude and costly.

The discovery of gold in California stimulated prospecting for this metal throughout the mountain regions of the west and incidentally led to the discovery of large and valuable deposits of other precious metal-bearing ores, such as the Comstock gold-silver mines at Virginia City, Nevada, the lead-silver mines at Leadville, Colo., and many others. The discovery of these large bodies of complex ores created a necessity for new metallurgical processes and improved methods of treatment.

The inventive genius of American metallurgists and chemists asserted itself and an era of improvement in old methods and discovery and development of new processes followed rapidly until today American mining and metallurgical practice is recognized as pre-eminent the world over.

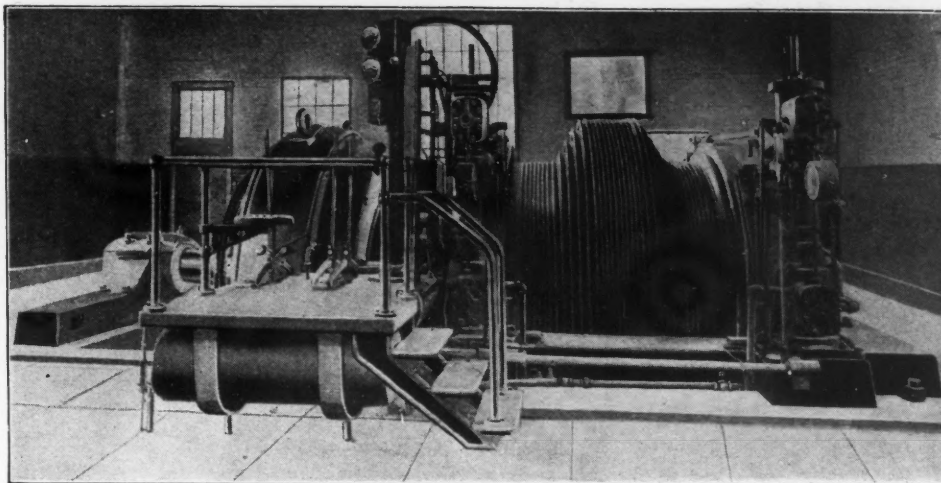
Concurrent with the discovery and development of new metallurgical processes and methods for the treatment of ores, American Mechanical Engineers and Manufacturers invented and improved the mechanical apparatus and equipment necessary to make such new processes and methods mechanically and commercially operative.

Present day mechanical equipment used in connection with mining and metallurgical operations has reached a high state of perfection in this country. ALLIS-CHALMERS MANUFACTURING COMPANY and its predecessors, Fraser & Chalmers, E. P. Allis Company and Gates Iron Works, have unquestionably been the largest contributors to the development and improvement of this class of machinery. "ALLIS-CHALMERS" machinery is recognized as Standard everywhere and is to be found in every prominent mining district in the world.

No other manufacturer is in position to offer on such a complete line of mining and metallurgical machinery, including Power and Electrical equipment, designed and built under the direction of one organization, as Allis-Chalmers Manufacturing Company. Its products include a complete line of hoists, pumps and compressors for mines, ore crushers and fine grinding equipment, including ball and rod mills, concentration, cyanidation and chlorination machinery, roasting, smelting and converting equipment.

ALLIS-CHALMERS MANUFACTURING CO.
MILWAUKEE, WIS. U.S.A.

VULCAN



Vulcan Cylindro-Conical Hoists

For great depths and large loads, hoists equipped with double cylindro-conical drums have proved to be the most economical type. The obvious advantage of this drum is that it reduces the starting load; the acceleration of the ascending cage occurs while the rope is winding on the small diameter. A very appreciable saving in power is thus effected, and a smaller motor may be used.

Then, too, with this type of drum less braking is needed to bring the cage to a stop; wear on the mechanical parts of the hoist is thus reduced to a minimum—lower up-keep cost and longer life results.

The illustration shows a Vulcan of Wilkes-Barre Hoist equipped with double cylindro-conical drums, typical of many installations throughout the bituminous and anthracite fields.

Tell us of the conditions which you wish to meet. For over seventy years we have been building hoists to meet widely varied requirements.

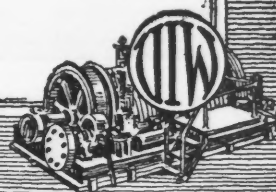
VULCAN IRON WORKS

Established 1849

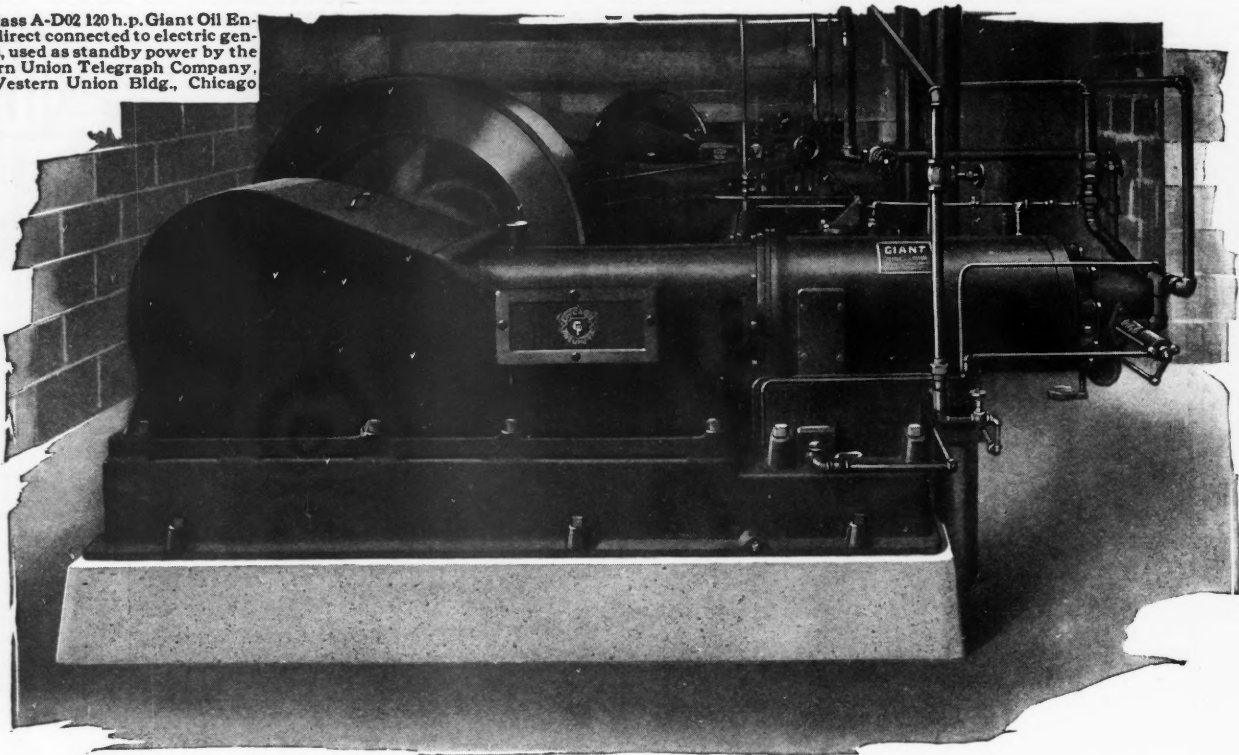
1733 Main St., Wilkes-Barre, Pa., U. S. A.



VULCAN



Two Class A-D02 120 h.p. Giant Oil Engines, direct connected to electric generators, used as standby power by the Western Union Telegraph Company, new Western Union Bldg., Chicago



Why Giant Oil Engines have a cross-head

THE Giant cross-head and the efficient lubrication system which it makes possible, *double engine life.*

Giant cross-head construction conforms to high-grade steam engine design. It prevents side pressure against the cylinder walls. It obviates uneven cylinder wear, worn pistons, loss of compression and consequent hard-starting. It reduces friction to a minimum. It provides easy accessibility to all moving parts by

permitting the use of readily removable frame covers. It permits compressing the charging pressure in the cylinder proper, and not in the crank case where leakage is almost unavoidable. It allows the crank end of the cylinder to be closed, thus providing for full *automatic splash lubricating system.*

The Giant system of lubrication is *positive-oiling, continuous in circulation, entirely automatic.* It saves time and saves oil.

Longer life and lower power costs invariably result from these and other Giant features that prove the worth of Giant Engines on a cost-per-year basis.

How much can Giant Oil Engines reduce *your* power bills? Engineering counsel, extended without obligation, is available to assist you in answering this important question. Giant Engines are built in single and duplex types, capacities 12 to 200 h. p. Ask for Bulletin 389.

Chicago Pneumatic Tool Company

Chicago Pneumatic Building • 6 East 44th Street • New York

Sales and *Service Branches all over the World

*BIRMINGHAM *CHICAGO *DETROIT FRANKLIN *LOS ANGELES *NEW YORK RICHMOND *SEATTLE BARLE BRUSSELS COPENHAGEN HELSINGFORS *LONDON MONTEVIDEO PARIS SANTIAGO SHANGHAI TORONTO
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 *BUFFALO *CLEVELAND ERIS JOPLIN *NEW ORLEANS *PITTSBURGH *SAN FRANCISCO BOMBAY CHRISTIANA HAVANA JOHANNESBURG MILAN OSAKA *ROTTERDAM SEOUL TOKYO WIDNES

EN 41

BOYER PNEUMATIC HAMMERS • LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
 CHICAGO PNEUMATIC AIR COMPRESSORS • VACUUM PUMPS • PNEUMATIC HOISTS,
 GIANT OIL AND GAS ENGINES ROCK DRILLS • COAL DRILLS

GIANT

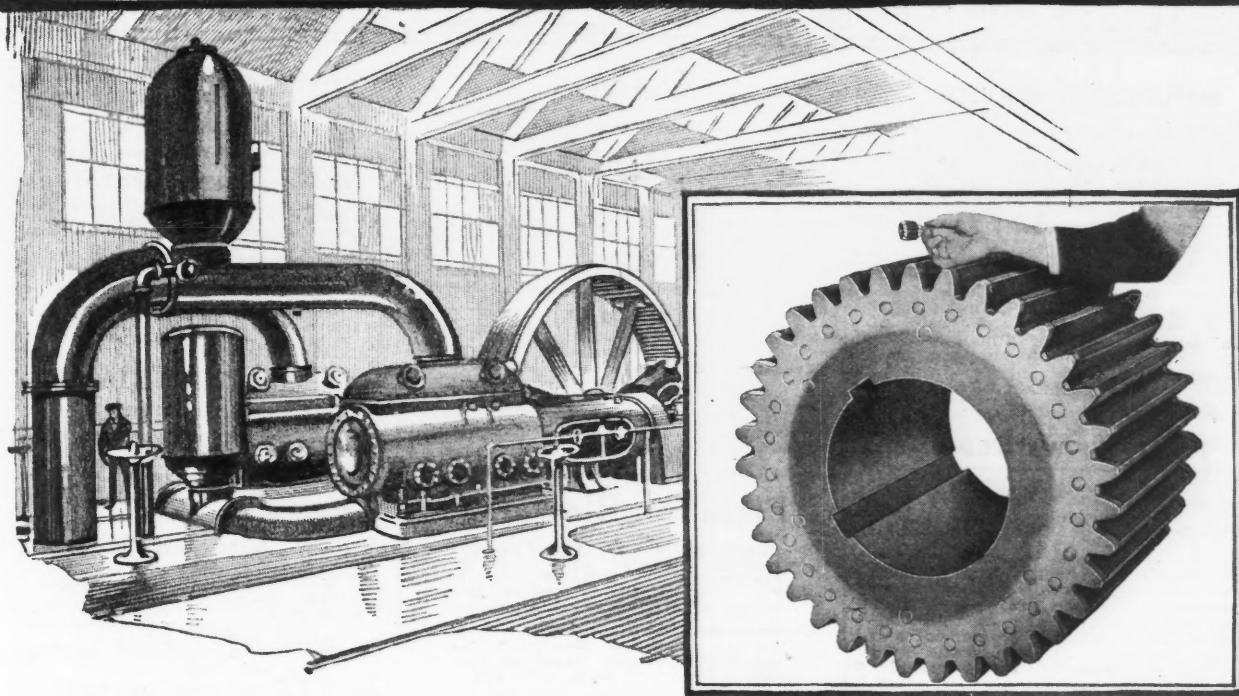
Dependable Power at



ENGINES

Less Cost Per Hour

Geared machinery that operates quietly and with very little vibration is sure to have a longer and more useful life



*A handful of cotton is used for the smallest Fabroil Gear—
about two bales for the largest*

Fabroil Gears make pump operation smooth

Used as motor pinions driving duplex, triplex and quadruple pumps, and operating for long periods without shut-down, Fabroil Gears have proved their worth.

Where metal gears were unequal to the task, the combined strength and elasticity of Fabroil Gears made possible rapid operation without

racking. Unaffected by oil, water or change in temperature, and working in the open or in humid fume-filled interior, these gears give satisfactory service.

For a wide range of uses Fabroil Gears are made in any sizes from one inch diameter upward. All sizes are used in the operation of pumps.

Ask the nearest G-E office for complete information

**General  Electric
Company**

General Office
Schenectady, N.Y.

Sales Offices in
all large cities

40-1701

ENGINEERING & MINING JOURNAL

Think "SEARCHLIGHT" First

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POSITIONS VACANT—Business Opportunities and other undisplayed ads, 8 cents a word, minimum \$2.00 an insertion.

POSITIONS WANTED—Evening work wanted, tutoring and other undisplayed ads of individuals looking for employment, 4 cents a word, minimum 75 cents, payable in advance.

ADD 5 WORDS for box number in undisplayed ads if replies are to any of our offices. There is no extra charge for forwarding replies.

DISCOUNT OF 10% if one payment is made in advance for 4 consecutive insertions of undisplayed ad.

ADS IN DISPLAY TYPE—Space is sold by the inch (30 in. to a page), the price depending upon total space used within a year, some space to be used each issue.

RATE PER INCH for ads in display space:

1 to 3 in.	\$4.50 an in.	15 to 29 in.	\$3.90 an in.
4 to 7 in.	\$4.30 an in.	30 to 49 in.	\$3.80 an in.
8 to 14 in.	\$4.10 an in.	50 to 99 in.	\$3.70 an in.

EMPLOYMENT SERVICE

EXECUTIVES qualified for salaries of \$2,500 to \$25,000 and upward, are invited to communicate confidentially with the undersigned, who will conduct preliminary negotiations for such positions. A procedure is used which places you in the position of being approached, avoids jeopardizing present connections, and conforms to the most exacting personal and ethical requirements. Of particular advantage as a test of conditions, to determine the advisability of changing. Details mailed confidentially on receipt of name and address only, without obligating or committing you in any way. Established 1910. R. W. Bixby, Inc., 303 Lockwood Building, Buffalo, New York.

POSITIONS WANTED

CHIEF chemist and metallurgist, experienced zinc, manganese, steel works, drop forging, heat treatment. PW-311, Eng. & Min. Journal, Old Colony Bldg., Chicago, Ill.

METALLURGICAL chemist and millman desires connection as mill superintendent or assistant; fourteen years' experience in the States and Mexico in mill construction and operation; economical and efficient treatment of low grade gold silver ores in particular; prefer cyanidation or flotation; age 37; fluent Spanish. PW-312, Eng. & Min. Journal.

METALLURGIST and smelter executive available. Technical education. Eleven years in laboratories and plant investigations, ten years metallurgist and superintendent at copper and lead smelters. Reverberatory and blast furnace experience. PW-510, Eng. & Min. Jour., Old Colony Bldg., Chicago, Ill.

MILL superintendent desires charge of plant; long varied experience milling and cyanidation; graduate, unmarried, Spanish. PW-314, Eng. & Min. Journal, 531 Rialto Bldg., San Francisco, Cal.

MINING Engineer, 20 years' experience as engineer, superintendent and manager in U. S. and Latin-America desires position. Speaks Spanish. PW-309, Eng. & Min. Jour., Real Estate Trust Bldg., Phila., Pa.

REVERBERATORY management wanted by one that knows from practical experience how to get results and make improvements when needed. Record: fireman and skimmer 7 years, foreman 10 years, superintendent 10 years. Speaks Spanish. PW-313, Eng. & Min. Journal, 531 Rialto Bldg., San Francisco, Cal.

YOUNG mining engineer wanted to represent the interest of a corporation engaged in mining enterprises. DeLyon, Howth & Co., 40 Exchange Pl., New York City.

FOR SALE
SILVER MINING PROPERTY

In Austin, Nevada, consisting of approximately 1200 acres, one-half of which are patented. Last owned by Austin-Manhattan Consolidated Mining Co. Includes old mines of the MANHATTAN MINING CO., with record production of over TWENTY MILLION DOLLARS. None of the old mines are deep.

WM. A. MARSHALL
Resident Agent, Austin, Nevada

I will purchase choice mineral specimens crystallized and showy ones. Crystallized gold specimens desired and will pay good premium on same. I sell at \$28.50 delivered MINERAL COLLECTION 115 specimens containing every important mineral spec. Pamphlet supplied.

G. S. SCOTT
20 Nassau St., New York

WANTED

Used Carbon (Black Diamond) and Borts And fragments wanted: Will pay highest prices. D. Dessau, Printing Crafts Bldg., 33d to 34th Sts. and 8th Ave., New York City.

Maurice S. Dessau, 6 Maiden Lane, N. Y. C. Will pay highest prices for carbon (black diamonds), large or small used stones, also fragments. Merchandise purchased

FOR SALE

Gold Mine
I have a mine at Manhattan, Nevada, 1,300 ft. of tunnels, ore free milling; average value \$10 a ton; seven claims. Will sell or form company to build mill. Full particulars from J. D. Johnston, Newport, Rhode Island.

Flotation Blowers

28—Connersville Blowers. Double outboard bearing. Capacity, 24-5 cu.-ft. per revolution, 3,200 cu.-ft. per minute at 255 r.p.m. Maximum pressure, 4.58 lb. per sq. in. at 255 r.p.m.

7—Roots Style D High Pressure Type Blowers. Capacity, 890 cu.-ft. per minute at 435 r.p.m. Maximum pressure, 9 lb. per sq. in. at 435 r.p.m.

These blowers were purchased for the Old Hickory Powder plant. Some were never installed and others were used less than 90 days. Practically new machines at used prices.

Nashville Industrial Corporation
Jacksonville, Tenn.

New Rails—Relayers
Cars, Locomotives, Steel Products

Send us your inquiries

MERCHANTS STEEL & SUPPLY CO.
208 S. La Salle St., Chicago, Ill.

PUMPS

From Old Hickory Powder Plant
Motor Driven Centrifugal

- 8—14-in. Worthington, Class B double suction, 3,500 G.P.M. at 152 feet head, at 1,170 R.P.M. direct connected to 300 hp. G. E., 3 phase, 60 cycle 2,200 volt motors.
- 4—14-in. Allis-Chalmers, Type S, 7,500 G.P.M. at 130 feet head, at 1,760 R.P.M. direct connected to 300 hp. General Electric, 3 phase, 60 cycle, 2,200 volt motors.
- 2—10-in. Allis-Chalmers, Type S, 3,750 G.P.M. at 130 feet head at 1,765 R.P.M. direct connected to 150 hp. Westinghouse, 3 phase, 60 cycle, 2,200 volt motors.

Steam Turbine Driven
Centrifugal

- 6—16-in. Allis-Chalmers, Type S, 8,500 G.P.M. at 90 feet head, direct connected to Type L, 300 hp. 2,000 R.P.M., G. E. Curtis Steam Turbine.
- 6—14-in. Allis-Chalmers, Type S, 6,500 G.P.M. at 150 feet head, 3,100 G.P.M. at 90 feet head, direct connected to 300 hp., 2,000 R.P.M., G. E. Curtis Steam Turbine.

Steam Actuated Hydraulic

- 5—14-in. and 20 x 7- x 18 Worthington Compound Duplex outside packed plunger pot valve, 400-g.p.m. at 300-lb. pressure.
- 8—25 and 38 x 41 x 24 Worthington Tandem Compound Duplex, outside packed 3,600 lb. pressure, 150-g.p.m. at 20-r.p.m.
- 1—20 x 12 x 16 Worthington Duplex Underwriters Fire Pump, 1,500-g.p.m., 100-lb. pressure.
- 200—New and used Simplex and Duplex, steam driven Worthington Pumps, 4 1/2 x 3 1/2 x 4, 5 1/2 x 4 1/2 x 5, 6 x 4 x 6, 7 1/2 x 4 1/2 x 10, 6 x 2 1/2 x 6.
- New and used Belted, 2 1/2, 3, 4, 5 and 6-in.
- 100—Centrifugal Pumps.

Nashville Industrial Corp.
Jacksonville, Tenn.

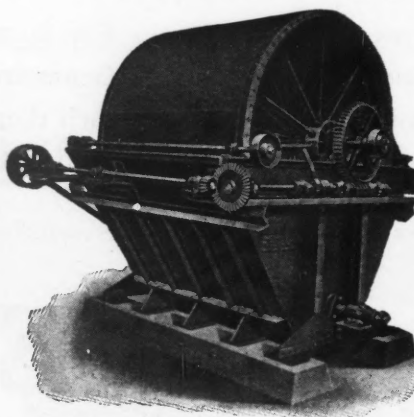
FOR SALE—One 30-in.

Circular Blast Furnace

complete with extra set of jackets, together with No. 5 Sturtevant Rotary pressure blower, same directly connected to 20 hp., 220 volt alternating motor. Price complete \$1500.

Goldsmith Bros. Smelting & Refining Co.
Heyworth Building, Chicago, U. S. A.

CONTINUOUS FILTERS



- 1—12 ft. x 7 1/2 ft. Portland Continuous Filter.
- 2—12 ft. x 8 ft. Portland Continuous Filters, with steel tanks, 16 in. x 60 in. receiver, moisture trap, 1 1/2-in. centrifugal pump, and 9 1/2 x 8 dry vacuum pump.
- 4—12 ft. x 9 ft. Portland continuous filters, with steel tanks.
- 1—14 ft. x 12 1/2 ft. Portland Continuous Filter, with steel tank.
- 1—14 ft. x 12 ft. Oliver Continuous Filter, with mechanical agitator and air lift.

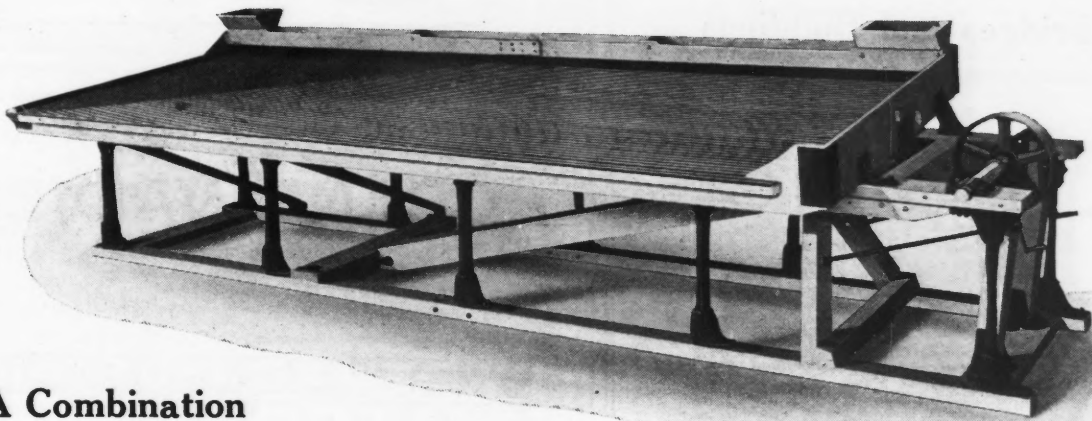
Write for full specifications.

We are Western Representatives of NASHVILLE INDUSTRIAL CORPORATION, handling the "OLD HICKORY" Powder Plant at Jacksonville, Tennessee. Full information, prices, photographs, etc., can be furnished by us.

THE MORSE BROS. MACHINERY & SUPPLY CO.

Denver, Colo.

The UNIVERSAL CONCENTRATING TABLE



A Combination of Simplicity, Capacity and Recovery

Its Complete Head Motion has Only One Operating Part—A weighted pulley.

Its deck swings in the Arc of a Circle—the head end parallel to the length of the deck—the concentrate end away from the tailings discharge side.

The Rifles approximately parallel the motion and curve away from the tailings discharge side, but not as much as the motion.

The Concentrates travel away from the tailings discharge side—uphill and slightly away from the riffles.

The Side Swing at the concentrate end spreads the concentrates and makes a clean separation.

The Proper Tilt of the deck is not dependent upon the amount of concentrates in the ore.

Its Recovery is not affected by changes in the proportion of concentrates in the feed.

Its stroke automatically increases with overload or decreases with underload.

This One Machine handles every feed from $\frac{1}{4}$ inch to slimes without change in design or construction.

The Combination of the Live Head Motion, Circular Arc Motion and Riffling and a "Dipping" Deck produces a speed of Pulp Travel and an efficiency of Concentration not approached by any other table ever produced.

Sands, Slimes and Coal Washing Types.

*Send for our bulletins on concentrating
and amalgamating machinery*

Also Simplex Oil Burner Bulletin

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Manufacturers of Oil Well and Mining Machinery

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AMERICAN BRIDGE COMPANY

Hudson Terminal, 30 Church Street
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Manufacturers of Steel Structures
of all classes, particularly

Bridges and Buildings

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Duluth, Minn.
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Pacific Coast Representative:

U. S. Steel Products Co., Pacific Coast Dept.
San Francisco, Cal. Portland, Ore.
Seattle, Wash.

Export Representative:

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Jenkins Valves



Jenkins Selclo Valve

FIGURE 357 is a valve which is self-closing and is commonly termed the "Selclo" Valve. It can be used on steam, air, or water lines and in factories, shops, and plants where different people use the valve. It is built for extremely severe service. This valve may also be used as a blower valve in rail road round houses. Genuine Jenkins Valves bear the Diamond Mark identification and are sold at supply houses everywhere.

JENKINS BROS.

New York Boston Philadelphia
Chicago Montreal London Havana

FACTORIES: Bridgeport, Conn.;
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WE-FU-GO AND SCAIFE

WATER

PURIFICATION SYSTEMS
SOFTENING & FILTRATION
FOR BOILER FEED AND
ALL INDUSTRIAL USES

WM. B. SCAIFE & SONS CO. PITTSBURGH, PA.

FOSTER SUPERHEATERS

A necessity for turbine protection, engine cylinder economy and utilization of superheat for all its benefits.

POWER SPECIALTY COMPANY, Boston Philadelphia Kansas City Pittsburgh
Chicago San Francisco Dallas London, Eng. 111 Broadway, New York

KNOX VALVES & COUPLINGS
For the Economical Preservation of Air
KNOX MFG. CO.
821 Cherry St.
Phila. Pa.

DIAMOND CORE DRILLING

Accuracy Since Reliability
1884

Booklet 2122
SULLIVAN MACHINERY CO.
126 S. Michigan Ave., Chicago



Harbison-Walker Refractories Company

MANUFACTURERS OF

High Grade Silica, Chrome,
Magnesia, and Fire Clay Brick,
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PITTSBURGH, PA.

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DIAMOND DRILL CONTRACTORS

20 Years' Continuous Service—Not a Dissatisfied Customer
Rolla, Missouri

Home: State Geologic Survey, Missouri School of Mines

McKiernan-Terry Drill Co.

Manufacturers of

Rock Drills—Hammer Drills—Core Drills
Pile Hammers—Atlas Jacks

21 Park Row, New York

FILTER BAGS SPECIAL CLOTH FILTER COVERS

FLOTATION POROUS BOTTOMS

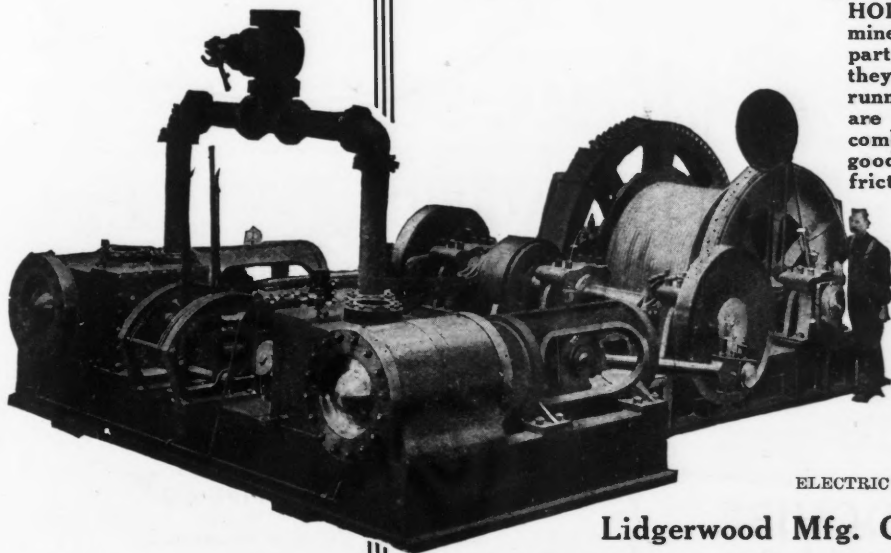


LIDGERWOOD MINE HOISTS

STEAM HOISTS up to 1000 hp.

ELECTRIC HOISTS in all sizes

THE DESIGN OF THE LIDGERWOOD HOIST is based upon careful study of mine conditions by our engineers. All parts have ample strength for the work they have to perform when the hoist is running at its full capacity. All parts are properly proportioned, and this combined with proper materials and good workmanship reduces internal friction to the minimum.



There is
STRENGTH
CAPACITY
ECONOMY
in
LIDGERWOOD HOISTS

Send for Catalogs on
ELECTRIC MINE HOISTS—STEAM MINE HOISTS

Lidgerwood Mfg. Co., 96 Liberty Street, New York

Philadelphia Pittsburgh Chicago Detroit Seattle Los Angeles Cleveland London, England

Barrett Standardized Flotation Reagents

The majority of the large flotation operators who have spent thousands of dollars investigating Flotation Oils and Reagents

Now Buy The Barrett Brand

A small trial order will bring you to the same conclusions they have reached.

The *Barrett* Company

40 Rector Street, New York City Salt Lake City, Utah

FLOTATION

PURE PINE OIL PINE TAR OIL
HARDWOOD AND COAL TAR CREOSOTE

Effective Oils of Each Class

General Naval Stores Co., 90 West St., New York

PINE FLOTATION OILS

Standard "350" Crude and other PENTARCO pine flotation oils. Used by leading American operators.

Manufactured and distributed by

Pensacola Tar & Turpentine Co.
Gull Point, Florida

Hercules Pine Oil

We desire to co-operate with flotation operators in determining what oils will insure them the largest net earnings.

Efficient flotation can be had only with uniformity in every shipment of pine oil. We are prepared to furnish you with Hercules Pine Oil of absolute uniformity produced under strict chemical control.

We invite correspondence from anyone interested and offer the experience of our technical service men in helping you solve your flotation problems.

Naval Stores Division

HERCULES POWDER CO.

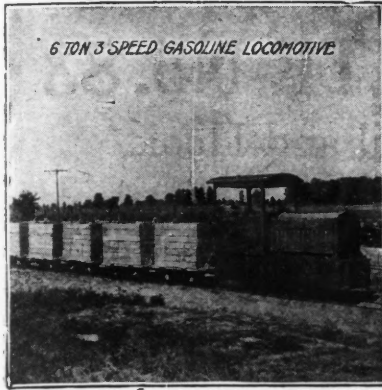
Wilmington Delaware

Sales { 120 Broadway, New York
332 S. Michigan Ave., Chicago
Offices { 1012 Chronicle Bldg., San Francisco
1019 Kearns Bldg., Salt Lake City, Utah



HERCULES Pine Oil

Produced Under Chemical Control



6 TON 3 SPEED GASOLINE LOCOMOTIVE

WHITCOMB LOCOMOTIVES

IT WILL PAY YOU TO GET OUR PROPOSITION BEFORE YOU BUY

GEO. D. WHITCOMB CO.

MAIN OFFICE AND WORKS

ROCHELLE, ILLINOIS
U. S. A.

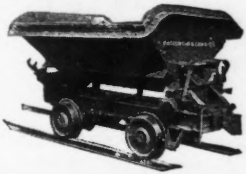


2 1/2 TON 3 SPEED GASOLINE LOCOMOTIVE

STORAGE BATTERY LOCOMOTIVES—1 TO 8 TONS ON DRIVE WHEELS

GEAR AND FRICTION DRIVEN GASOLINE LOCOMOTIVES—2 1/2 TO 25 TONS ON DRIVE WHEEL

EASTON CARS



Ruggedly constructed Easton Rocker Dump Cars, cars of all types, standard or special, and complete narrow gauge railway equipment from track up—built for enduring service and backed up by thirty years of Easton experience—are available for every car haulage requirement in the metal mining and refining industry.

EASTON CAR & CONST'N CO.



42 Church St., New York—Works: Easton, Pa.

Atlanta Chicago Detroit Philadelphia Pittsburgh
Boston Cleveland Dallas Los Angeles Salt Lake City



Nothing but cars — that's all we've built for 50 years. Our whole factory devoted to your requirements in this line.

Catalogues on request



The Watt Mining Car Wheel Co.
Barnesville, Ohio

Denver: Lindrooth, Shubart & Co., Boston, Bldg.
San Francisco: N. D. Phelps, Sheldon Bldg.
Philadelphia: Edelen & Co., 235 Commercial Trust Bldg.

ATLAS

STORAGE BATTERY LOCOMOTIVES

For Main Line, Surface, and Gathering Work

The Atlas Car & Mfg. Co., Cleveland, O.

cars-track switches

TRADE MARK REGISTERED
U. S. PATENT OFFICE

Koppel Industrial Car & Equipment Co.
Koppel, Pa.

New York · Pittsburgh
Chicago · Detroit
Philadelphia · San Francisco

ROTARY CAR-DUMPERS FOR MINE CARS (GRAVITY, ELECTRICAL OR PNEUMATIC DRIVE)

"SOLIDCAR" SELF-DUMPING CAGES CAR CONTROL AND CAGING EQUIPMENT

CHICAGO ILL. **CAR-DUMPER & EQUIPMENT CO.** PITTSBURGH PA.

THE MECHANICAL SPRINGER AUTOMATIC TRIP CONTROL EQUIPMENT

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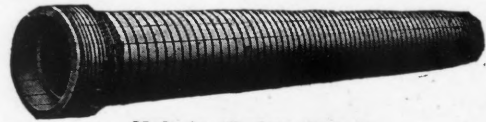
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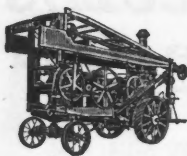
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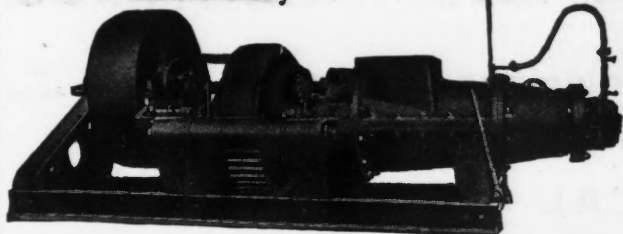
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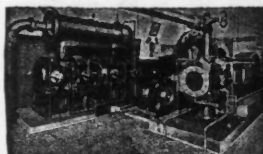


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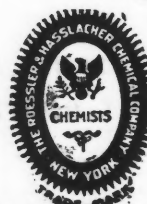
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- Mulliken, H. S.**, Consulting Metallurgist. Address Bureau of Mines, Washington, D. C. No professional engagements undertaken at the present time.
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V

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Van Winkle, C. T., Mining Engineer. Problems in Development, Mining and Milling. Dooly Block, Salt Lake City, Utah.

W

Ward, William F., Mining Engineer. Compania Minera Choco Pacific, Columbia, S. A., Via Buena Ventura.
Waring & Williams, Laboratories, Industrial and Analytical Chemists. Analyses, Tests, Metals, Ores. Zinc-Lead Reports. Joplin, Mo.
Warriner, R. C., Consulting Mining Engineer. Room 1804, 43 Exchange Place, New York.
Watson, Ralph A., Mechanical Engineer. Chief Engineer, Tennessee Copper Company, Copperhill, Tenn.
Watson, R. B., Con. Min. Eng. 165 Broadway, New York. Gen. Mgr. Nipissing Mining Co., Ltd., Cobalt.
Weekes, Frederic E., Mining Engineer. 233 Broadway, New York. Telephone Barclay 7583.
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Wheeler, H. A., Mining Engineer. Reports on Oil and Mining Properties. 408 Locust St., St. Louis, Mo. Cable: "Wah," St. Louis.
White, Rush J., Mining Engineer. Shoshone Bldg., Wallace, Idaho.
Whitman, Alfred R., Mining Geologist. Underground Programmes, Orebody Problems. 43 Exchange Place, New York. Haileybury Ontario (Cobalt District.)
Wilfley, Clifford E., Mining Engineer. Examinations and Management. Ouray, Colo.
Wilkins & Devereux, W. B. Devereux, Jr., J. H. Devereux, Consulting Mining Engineers. 120 Broadway, New York; 7 Victoria Avenue, London. Cable: Kenreux.
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Wright, Charles W., Min. Eng. Societa Romeo Esplorazione Minerale. 125 Via del Trione, Rome, Italy. Cable: Wright Itamerica, Rome.
Wright, Ira L., Mining Engineer. Examinations, Consultation and Management of Mines. Silver City, N. M.
Wright, Louis A., Mining Engineer, c/o Engineers Club, 32 W. 40th St., New York. Codes: Bedford-McNeill & Bentley's complete phrase.

Y

Yeatman and Berry, Consulting Mining Engineers. Examination, Development and Management of Properties. Room 1604, 165 Broadway, New York. Cable: "Ikona." Code: Bedford-McNeill.
Young, E. J., Consulting Geologist and Engineer. Offices and Laboratory. Story Bldg., Los Angeles, Calif. Examinations and Reports on all Mineral Deposits, Formations and Processes of Extraction. 20 years' experience in the Western States, Pacific Coast States, Mexico and Central America.
Yung, M. B., Technical Advisor to Bureau of Mines. Republic of China, Canton. No examinations undertaken.

Z

Zallnski, Edward R., Mining Engineer. 821 Newhouse Bldg., Salt Lake City. Examination, Geological Mapping Development.
Zeigler, Victor, Geological Engineer. Examinations of oil lands and mineral deposits. Geologic and structure maps. 415 Empire Bldg., Denver, Colo. Phone: Golden 119.

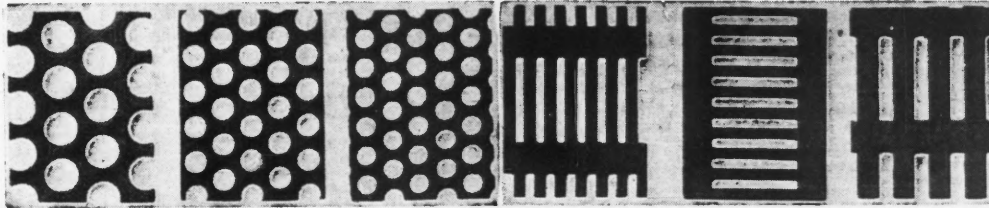
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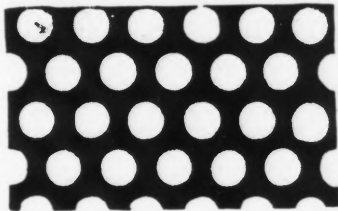
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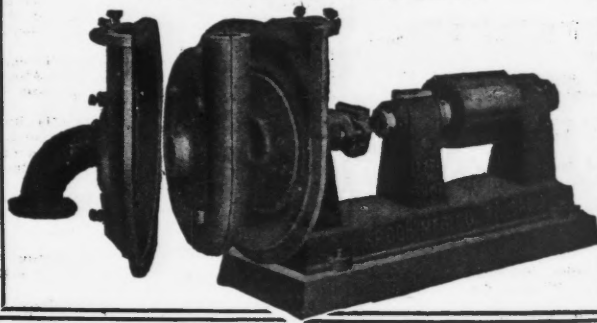
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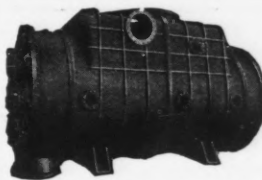


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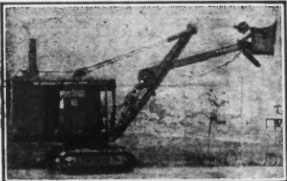
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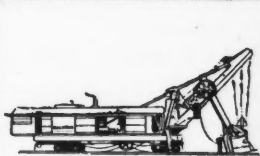
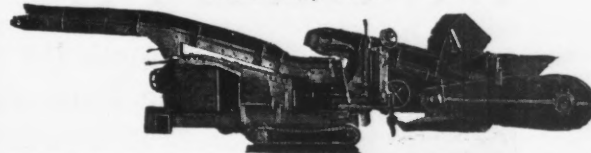
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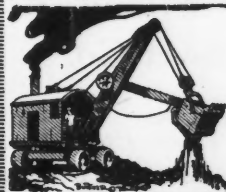
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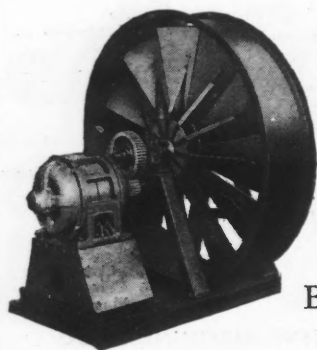
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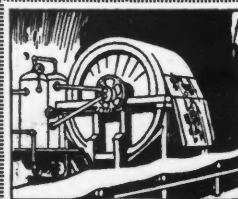


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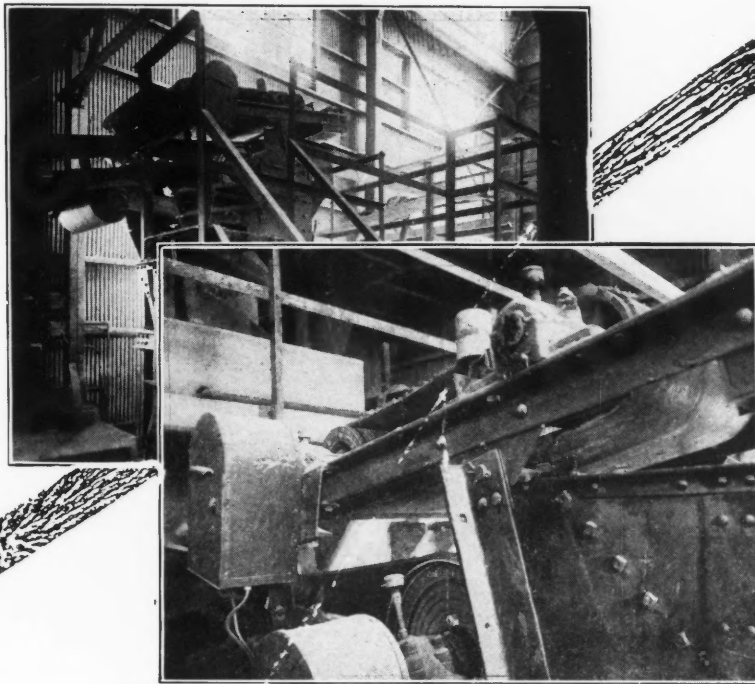


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The illustration at the left shows two Dings Pulley Type Magnetic Separators handling 220 tons per hour at Phelps Dodge Plant, Tyrone, New Mexico. A primary separator is installed at head end of conveyor; a secondary pulley is supported above belt. Close-up view at right shows another installation of specially arranged Dings Pulley Type Magnetic Separators.

Even where repairs cost nothing Magnetic Separation pays

IF the elimination of crusher repairs was the only saving that could be credited to Dings Magnetic Separators, many of the 3,000 Dings installations that are today in service would never have been installed.

What repairs magnetic protection will eliminate is a matter of chance. Perhaps a big repair will be avoided during the first week of operation—perhaps the actual repair costs eliminated will be small.

But, however small the breakage, one thing is certain: there will be a shutdown—and shutdowns are invariably expensive. Time is wasted; labor is wasted; production is dwarfed. That's why magnetic separation pays even where repairs cost next to nothing.

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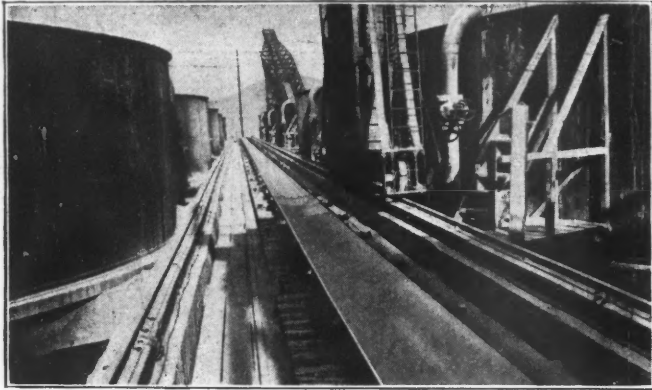
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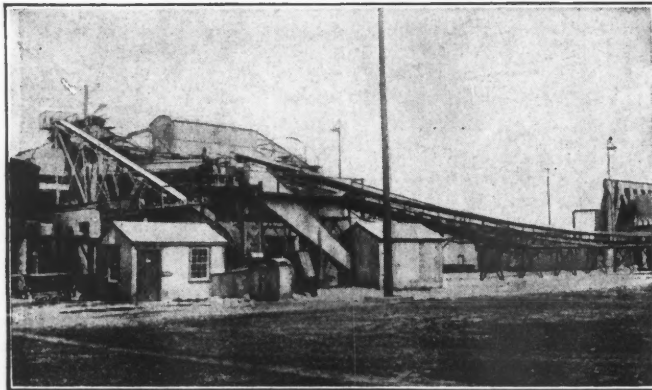
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In the far places



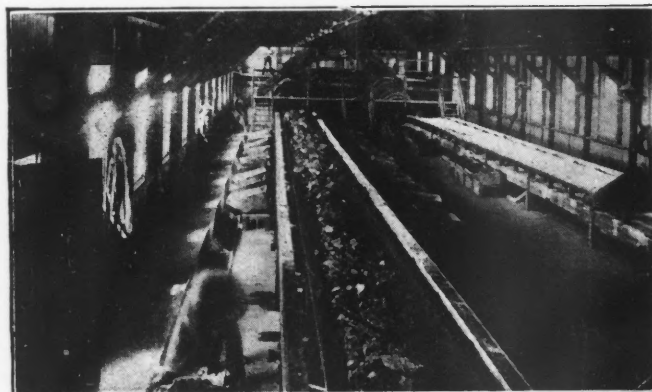
The Witwatersrand in South Africa, is a long, long way from the U.S.A. but Diamond Conveyor Belts are just as conspicuous there as at home.

Here are three photographs showing Diamond Belts on different installations of the City Deep and Roodeport United Mining Companies.



Notice the size of the rocks in the lower illustration and how straight the belt is running.

Some large users have been standardizing on Diamond Belts for twelve years, placing their orders by cable several months in advance of the time when the belts are actually needed. The increasing volume of orders indicates that users are not sparing in praise when talking with their mining friends.



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