

MAR 1925
 February 28, 1925

McGraw-Hill Company, Inc.

Twenty-five Cents Per Copy

ENGINEERING AND MINING JOURNAL-PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS

Marketing of Precious Stones

By George F. Kunz

Vice-President, Tiffany & Co., New York

Mining Methods at United Verde-I

By George J. Young

In Tanganyika and Kenya Colony

[PHOTOGRAPHS]

A Million Dollars' Worth of Diamonds

In the head office of the De Beers Mine, Kimberley, South Africa. This parcel of uncut stones has been separated and appraised at the value given by D. W. Smith, chief valuator, who is seated at the table.

Photo by courtesy of A.T. Williams, Manager of De Beers, Ltd.



S-A Unit Carriers for Heavy Duty Belt Conveyors

The S-A "Triple X" Carrier, illustrated below, is built for belts handling heavy lump material such as ore, coal and rock.

This carrier is made up of S-A Ball Bearing Units mounted upon rigid structural steel cross frame. The free-running ball bearing rolls are built entirely of steel and are designed to keep out the dirt and grit always encountered in handling bulk materials.

The "Triple X" is built for belts 24 to 54 inches wide. Write us. S-A Engineers are Glad to Offer Suggestions on Material Handling Problems.

Stephens-Adamson Mfg. Co.
AURORA, ILLINOIS

Designers and Builders of Labor Saving, Material Handling Machinery



ENGINEERING AND MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 119

New York, February 28, 1925

Number 9

A Plan for Conserving Petroleum

HENRY L. DOHERTY took the opportunity offered by the A.I.M.E. meeting in New York last week to place before the engineers and the public generally his plan—the so-called “Doherty plan”—for the conservation of petroleum by control of production. The plan had previously been explained by him to the directors and various committees of the American Petroleum Institute, and had aroused great opposition among the operators, he said.

Unit operation of oil pools yet to be discovered is the essence of the plan. The law of capture applied to petroleum leads to many evils, in Mr. Doherty's opinion. “Some man starts a wildcat well. If he strikes oil, there is an army of men there the next morning to make leases or to buy them and to start operations on the adjoining tracts of land. . . . It is a frenzied scramble to get down to the oil and get it out first. Gas in some cases to an energy value of more than the entire energy value of all of the oil which is recovered is blown to the air, and this in spite of the fact that if this gas were conserved it would greatly increase the amount of oil recovered and would enable every barrel to be raised to the surface without the cost of pumping. Oil must be taken from the ground whether the market needs it or not. . . .

“No matter what other checks or restrictions other people may feel must be placed upon the production of oil, it is my belief that we must provide for the unit operation of pools. Instead of paying the land owner his royalties according to the amount of oil captured on his land, we must pay all of them according to the amount of oil which underlaid their land as the oil and gas existed as an undisturbed pool.”

Specifically, the plan recommended proposes, first, that no land be drilled for oil until opened up by a government permit. Second, that all land within drainage distance of existing production be opened for drilling, thus enabling existing pools to be driven to their boundaries and without opening up other and distinct pools. Third, that permission to drill land not subject to drainage be granted only when an oil exploration district has been formed. All land embraced in the district that is one-half mile or more from the outer boundaries is to be opened for drilling without restriction. No drilling is to be done on the outer half-mile strip except with consent of all land owners within a half-mile of the proposed well. Other minor restrictions regarding the drilling of this narrow strip are also provided. Thus is the plan set forth.

Trenchant comment was noted for its absence in the discussion that followed the presentation of the paper. This was to be expected, however, as the majority of those present were either consultants or engineer employees of various petroleum producers, and would naturally hesitate to put their opinions on record without taking time to formulate them carefully.

It is easy to think up difficulties that such a plan

is likely to encounter. Of course, there would be difficulties: Mr. Doherty has anticipated many of them himself, and dealt with them in his paper. Is it legal? He thinks so. Under existing laws the Federal Government has the power necessary to pass such legislation, he believes. Then there is the political angle. Could such a plan get by in the face of the moneyed opposition of big operators, who have vast investments in pipe lines and refineries and who are fearful of the loss that a conservation program might entail? These and others like them are all questions hard to answer.

There is indeed but one reply: the nation's most important natural resource—for war or peace—is being squandered and nothing done to stop it. Mr. Doherty displays an acumen and farsightedness in his analysis of the situation. Better such limited government control today than national disaster later!

Mr. Doherty's proposal and the President's appointment of a board to study petroleum conservation seem intimately related. It is fortunate that there is this commission to give the plan proposed the consideration that it merits.

The Institute Winter Meeting

THE MEETINGS of the American Institute of Mining and Metallurgical Engineers in February continue to be the chief rallying place of the profession, as has been the case for so many years past. Men from various parts of the country, who have to be in New York sometime during the winter, or who can be, time their visit so as to mingle with the crowd of fellow engineers and fraternize with them, spying old friends and pleasant acquaintances everywhere. Technical and economic problems of the industry are seriously discussed in the various sectional meetings, where the essays are read which later (some of them) appear in the *Transactions*. The serious-minded and technically bent audiences, however, are apt to be numerically few. The profession has been repeatedly subdivided, so that a man reading a paper upon his own particular branch of work, in which he feels he has something new to offer, is likely to find few comrades who follow him, most being intent upon some divergent line.

Mining methods, milling methods, petroleum problems, and the human engineering phase of the industry are personally followed and developed, but perhaps without that general enthusiasm which was evinced twenty years ago, when the profession was younger, the mining schools not so thorough, and the literature not so extensive. Mining geology, also, meets with only a languid interest; this, again, is only one of the subdivisions of the profession. The conversation of two metallurgists frequently does not touch upon many points in common—nor that of two geologists.

The great common interest occasion of the Institute meeting is the smoker, where members may circulate,

and threads of common interest may be followed in the crowd. Here comes the multitude, which is sparsely represented at the technical meetings and overlooks the annual business meeting almost entirely. The responsibilities of citizenship as members of the Institute rest lightly upon the shoulders of the average Institute member. What he is interested in is the news and progress of the mining industries, the interplay of human relationship in mining, and the opportunity to use his brief leisure in the general interchange of ideas, from which more or less casual contacts many stimulating sparks are struck.

The Bingo Muddle

IN AN EDITORIAL in our issue of Oct. 25 we called attention to the doubt that had been raised in the minds of Canadian engineers and investors as to the soundness of the promotion methods of the Bingo mine, on Herb Lake, in The Pas district, Manitoba. Since then, many things have been happening. The Dorr Company, who had been asked to design a mill for the property, had previously taken some samples for laboratory testing, which samples had shown a goodly quantity of gold; and this fact had been broadcast by the promoters and officers of the company, evidently for its favorable effect. After the publication of our editorial referred to, the Dorr Company re-examined the ore, taking special precaution against the samples being tampered with; and found that the bulk of the material supposed to be ore was practically without value. The Dorr Company demanded that its adverse finding should be published in London; this was not done, but eventually the board asked Mr. John A. Dresser, of Ottawa, to sample the mine. Mr. Dresser's finding has not been published, but it is reported that he found an average of between \$1 and \$2; and that the result was approximately the same as that of Mr. J. A. Reid, who had previously been appointed consulting engineer to the mine. Even when Mr. Dresser's report was received in London, it was not given out, and, indeed, this has not yet been done. The board passed a resolution of confidence in Mr. Joshua Myers, of Winnipeg, the promoter; but a day or two afterward he was arrested at the instance of a Winnipeg firm, one of whose members is a director and large stockholder.

When the case comes to trial, the story will unfold further. Certain aspects, however, may at the present time be indicated. The gold-quartz veins of Herb Lake carry gold, but are spotty—large tonnages of milling ore are absent. The Bingo mine was not the best-looking prospect in the district; it adjoined the Rex, a mine having gold, but with the drawbacks above mentioned. It seems certain that Joshua Myers, managing director of the Bingo, gave out misleading and incorrect reports concerning the value and the grade of the ore, whereby narrow widths of quartz were expanded to great widths of ore (which included crosscuts in worthless country rock); and spotty assays were interpreted as applying to all this vast tonnage. Whether these extravagant statements were due to ignorance or a deliberate intention to deceive, the courts will determine.

Meanwhile, some acerbity has developed between Canadian and English mining groups as a result of this and similar instances. The English group is inclined to accuse Canadian mining of being unsubstantial in its methods, not to use a broader term; and to say that

therefore they will be chary of investing further capital in Canada. The Canadian group, on the other hand, inquires why the English capitalists do not get the advice of mining engineers, or, when they do get mining engineers, why they often pick an evidently incompetent and practically ignorant type.

Viewing this dispute from a third country, we confess our sympathy, at the present stage of the contest, with Canada, and in the case of the Bingo we have to inquire why the board in London should have been so eager to publish good reports and so averse to making public unfavorable ones. Doubtless psychology and distance entered into the problem: the confidence-inspiring personality of Mr. Myers, and the distance of London from The Pas. But what they are distinctly to be blamed for is for not checking up the investing of their money and that of the public by the reports of competent engineers, instead of depending upon the say-so of an ex-stockbroker. There are competent engineers in London, as there are in Toronto and in New York. Ordinary business methods would have saved those responsible for the existing situation this uncomfortable position.

To Collect Royalties on Side Feeding of Reverberatories?

A BOMBSHELL WAS DROPPED among the copper smelters last week when the decision of the United States Circuit Court of Appeals in San Francisco was announced, upholding the patent claims of George C. Carson for the side feeding of reverberatory furnaces, and reversing the decision of the Tacoma court which had held that Carson's patents were anticipated by the Siemens patent issued in 1866. The decision is final unless the Supreme Court can be persuaded to reopen the case. Though the suit was directed against the American Smelting & Refining Co., and Phelps Dodge Corporation, the claims for damages can be made against all companies operating copper reverberatory furnaces, since the practice of side feeding is universal, we believe. The patents will not expire until 1932 and 1936.

When reverberatory furnaces were first used, the charge was all added near the bridge wall, and fettling was introduced by hand in doors along the side walls to protect the brick. Dropping of this fettling material through holes in the roof however, seems to have been suggested in the Siemens patent, and is also claimed to have been planned by Henry L. Charles in 1905, 1906, and 1907. Mr. Charles obtained a patent for fettling reverberatories (No. 871,477, Nov. 19, 1907), though he seems to have had in mind the charging of fettling material only, along the side walls, whereas Carson had the idea of feeding all the ore by that method.

The first introduction of fettling through holes near the sides of the roof arch, on a practical scale, seems to have been at the Cananea smelter, at the instigation of William Gmahling, about November or December, 1906. At about the same time, George C. Carson, working independently, presumably on only a laboratory scale, applied for a patent for feeding ore along the side walls and through the roof, on Jan. 15, 1907, though it was eight years later, for some reason, before the patent, recently at stake, was issued. For some years following 1906 the feeding of fettling material through holes in the roof was regular practice at Cananea. In the spring of 1913, the Canadian Copper Co., after

studying Cananea practice, began feeding ore by this method, a practice which rapidly extended to other plants.

The only point of litigation so far has been as to whether or not the Siemens patent covers recent practice. In the first suit, against the Afterthought, the judge straddled the question by awarding Carson \$1 damages; the Tacoma judge decided that Carson had no case, and the San Francisco judge that his patent was valid. This is remindful of the varying opinions held by the legal talent in the Minerals Separation cases.

Some of the news dispatches suggest that Carson and his attorneys and financial backers, all of whom share in the prospective melon, will receive about \$20,000,000 in damages, though the A. S. & R. officials feel that their company can hardly be called liable for more than \$250,000. The press has given the matter considerable publicity, the New York *World* of Jan. 19 carrying the double-column head " 'Desert Rat' Won't Waste Millions in Futile Effort to Save Humanity—Charity Would Only Make Grafters, Says Carson, and He Will Not Marry, for He Doesn't Please Women, So He'll Just Invent Smelting Devices."

The matter of assessing damages will be difficult, as the difference in costs and recoveries between the old method of charging along the bridge wall, with hand fettling, and modern methods, would involve some rather complicated suppositions and calculations.

It is of interest to note that Carson is an inventor rather than a smelter operator, and that the originators of the practice on a commercial scale are apparently without patent protection. One of the things that has been lacking in this case is any good evidence, in the technical literature, of the use of side feeding antedating Carson's patent application. Apparently if the Cananea operators had gone on record regarding their work, when it was new, their rights might have been upheld. As we understand it, publication of a process prevents another from patenting it and demanding royalties. Or, an operator should immediately cover his improvements by applying for patents himself, for his own protection, even if he does not exploit them. Or he can do both.

Anaconda Improves Great Falls Zinc Plant

INDICATIVE OF THE PROGRESS being made in the hydrometallurgy of zinc is the fact that the Anaconda company is increasing materially the capacity of its Great Falls leaching and electrolytic plant by alterations in the equipment and practice that do not involve any additional installations.

Probably the most important development is in the direction of using solutions that are hotter and more strongly acid. The residues are to be treated with leaching liquors almost twice as strong as those formerly used, and increased extraction of zinc amounting to 5 per cent is anticipated. The stronger acid will effect the decomposition of zinc ferrite and result in more satisfactory elimination of arsenic and antimony. Another change is the higher current density in the electrolytic cells—about 50 per cent higher than that first employed. Economy of power, increased capacity in zinc for a given cell, and the formation of cathodes of better physical composition are the advantages. Another economy is effected by closer spacing of the electrodes, with a consequent saving of power.

Mechanical agitators displace the Pachuca tank, in

which compressed air is used for stirring, in the purification of pregnant leach solutions; and mechanical agitators likewise are being provided in the leaching department. Conservation of heat is attained, and the chemical reactions all tend to be more rapid and complete and more positive.

Anaconda metallurgists would be the last to withhold full credit where it is due; so it is fair to say that many of the modifications that are being made at Great Falls follow the practice developed at Martinez, Calif., and at Kellogg, Idaho, by U. C. Tainton and his associates with the Bunker Hill & Sullivan company. Mr. Tainton for several years has been a sturdy advocate of the use of high-acid solutions, of high current density, and of mechanical agitation. Both he and the Bunker Hill company have been most ready to explain the details of their work to interested visitors—a policy for which they deserve the commendation of metallurgists everywhere. The free exchange of technical data is one of the reasons for the rapid development of hydrometallurgy.

Mining Flow as Indicated by Mining Journal-Press Circulation

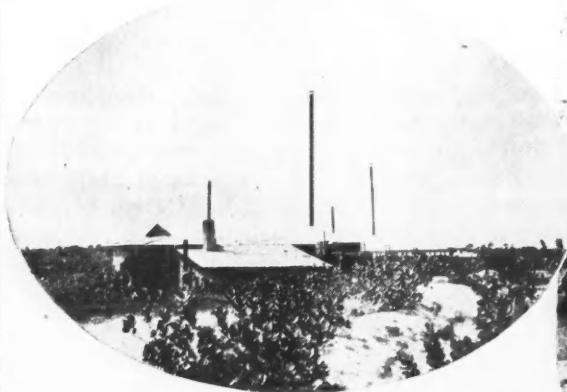
THE INCREASE IN MINING in countries outside the United States by English-speaking miners is probably indicated more accurately by the analysis of the circulation of *Mining Journal-Press* than by any other test. Some time ago we alluded to the increasing percentage of circulation in these countries—an increase which was a natural growth, and attended by no effort in that direction on the part of *Mining Journal-Press*. In 1920 the circulation outside the United States was 23.7 per cent. A recent analysis shows that it has grown to nearly 30 per cent. This is in accord with the tendencies which the chief editor has sketched out in his article on the "Evolution of Mining" in our issue of Jan. 3, in which he described the tides of mining enterprise and endeavor flowing beyond the boundaries of the United States to other parts of the world—a tide pent up by the failure of capital to find new and attractive sources of investment at home to replace mines already worked out or in process of being so.

That much of this increasing foreign circulation is indeed by American interests who have spread out beyond the boundaries of the United States is indicated by the recent figures of the Department of Commerce, showing the comparison between exports of mining machinery from the United States in 1923 and in 1924. The figures are in dollars.

	1923	1924
Rock drills.....	\$1,121,946	\$1,077,472
Mine cars.....	378,673	517,660
Mine hoists.....	177,346	299,884
Ore crushing and sorting machinery.....	1,593,866	2,140,930
Amalgamation and flotation machinery.....	178,699	228,432
Smelting and roasting machinery.....	186,320	316,960
Total.....	\$3,636,850	\$4,581,338

While England and Germany and even France export a great deal of mining machinery, the greatest business of mining-machinery manufacture is obviously in the United States, and the increasing shipments abroad probably indicate the natural tendency of American-built machinery to follow the American dollar in its travels abroad; just as English-built mining machinery finds a preferred market in South Africa and India, following the pound.

1916 TANGANYIKA and KENYA COLONY



Stamp mill and cyanide plant at Sekenke Tanganyika Territory. These mines have produced about 50,000 oz. of gold



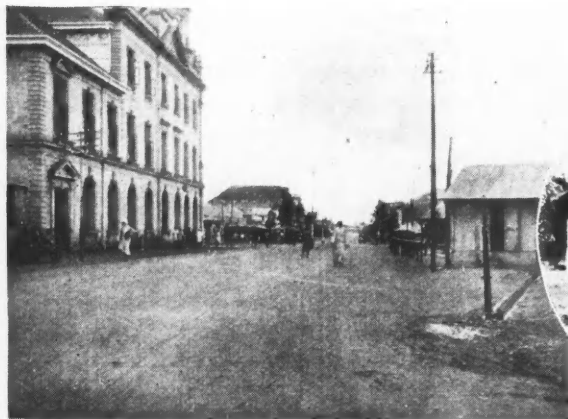
Assay office and houses built by the German company which worked the mines at Sekenke, 1909-1915



Transportation methods in Tanganyika. Natives carrying peanuts to railway at Tabora



Oldonjo-Lengai (Mountain of God) a volcano near western edge of Great Rift Valley, Tanganyika



A street in Nairobi, capital of Kenya Colony



Settler's homestead near base of Mt. Kenya, 120 miles north of Nairobi

Mining Methods at the United Verde—I

*Open-pit Mining by Bench and Glory-hole Systems—Use of Well Drills and Large Steam Shovels
—Shaft and Adit Development—Electrical Hoisting and Transportation
—Standard-gage Mine Tracks*

By **George J. Young**
Associate Editor

THE UNITED VERDE copper deposit is unique with respect to size and to continuity in depth. The principal orebody is an irregular mass of pyrite and chalcopyrite of consistent copper content. This grades more or less gradually into pyrite on the

ciated schist. Sulphide stopes vary greatly in silica content. The mining problem thus has to do with a variety of separate but related orebodies of varying size. Both development and methods on the subordinate orebodies must be correlated with the work upon the larger orebodies.

The ore deposit reaches the surface, an oxidized zone extending to the 160 level. The upper zone of the ore deposit was mined by square set and fill. The frequent occurrence of fires, and finally the difficulties arising from the attempts adequately to control these fires, resulted in the abandonment of underground mining operations entirely in the upper levels above the 500 level, partial abandonment between the 900 and 500 levels, and recourse to open-pit mining. The present mining operations therefore divide themselves into three separate groups, the open-pit workings, the underground mining of the principal ore mass, and the mining of the smaller related ore masses in the schistose footwall zone.

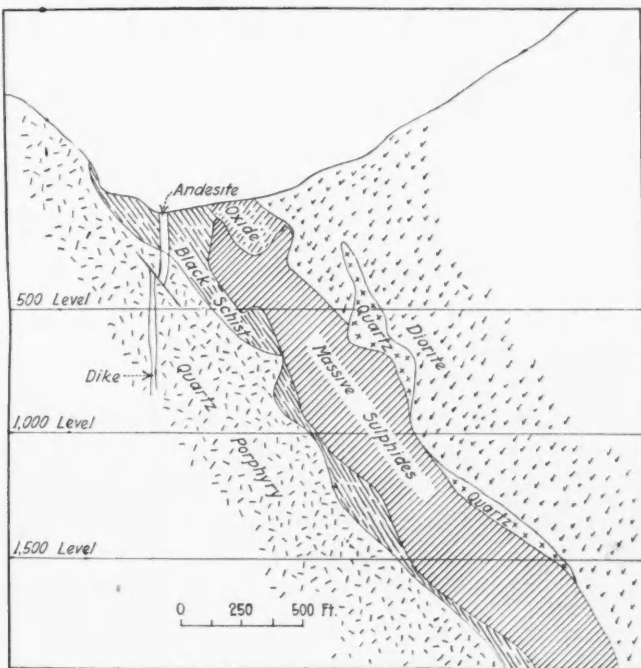


Fig. 1—General geological features of United Verde deposit. Section in plane of dip

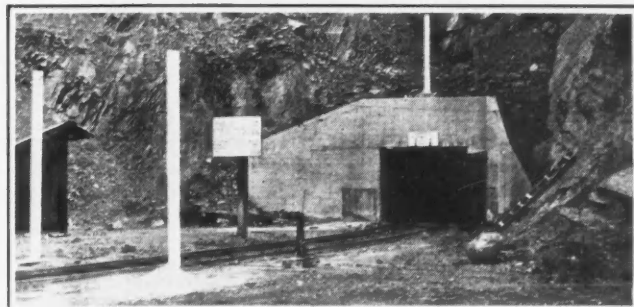
hanging-wall side and into schist on the footwall. In the footwall schist, lenses and smaller orebodies of varied grade and composition occur. Diorite forms the hanging-wall boundary and quartz porphyry the footwall. Occasional orebodies are found in the porphyry. The accompanying cross-section shows the general features of the deposit. The main ore lens is 700 ft. or more long and 150 ft. in width on the 1,650 level. The dimensions vary at different levels, the principal orebody pinching to nothing at the 1,200 level and ranging up to a 40-ft. width on the bottom levels. The orebody pitches downward at a relatively steep angle.

The pyrite-chalcopyrite ore is hard and tough. It is in a high degree capable of supporting itself over a wide opening. It breaks in relatively large pieces. The mining problem concerns itself with economical breaking, ore movement, and the filling of the void left by mining by extraneous material, as there is little waste associated with the ore. The orebodies in the schist are more or less uniform except in grade of ore, which varies widely. Some are distinctly of the same character as the principal ore mass, and others have a greater proportion of quartz and more or less asso-

OPEN-PIT OPERATIONS

Open-pit mining will require a relatively short time for completion as compared with the life of the underground operations. The rate of mining is determined by the number of digging machines. The number of digging units has therefore been selected to win the open-pit ore within the time interval measured by their useful operating life. The accessory equipment, cars and locomotives, was determined by the output of the digging machines and the average distances over which ore and overburden had to be moved.

The open pit advances from the 160 level southwest-erly into a hill more or less along the axis of a ravine. The orebody has been uncovered in the southerly end of the pit. In the north end a considerable amount of overburden remains to be removed. Approximately



Portal of 500-level adit

two cubic yards of stripping must be excavated for each ton of ore mined. The overburden is principally hard rock, diorite, more or less weathered, and must be drilled and blasted. The ore is softer. The general plan of attack is to remove the overburden and win the ex-

posed ore above the 300 level by steam-shovel mining. The ore below this level (extending to the 500 level) and to some extent above it will be won by a system of mill holes. At present several mill holes are being worked on the ore exposed at the edge of the open cut.

In the lower part of the pit, 50-ft. benches are carried. The uppermost bench is 130 ft. at the highest point and is in overburden. A system of eleven switchbacks serves the different levels, and the present trackage totals 8.57 miles, of which 6.3 miles is main track, 0.93 pit tracks, and 1.34 miles dump tracks. The pit is a difficult one, but has been laid out as advantageously as the topographical conditions permit. The waste dumps are relatively close, and the haulage distances are therefore short. Ore is dumped into raises extending to the loading bins at the Hopewell tunnel level. This restricted ore and waste movement by cars is characteristic of this operation.

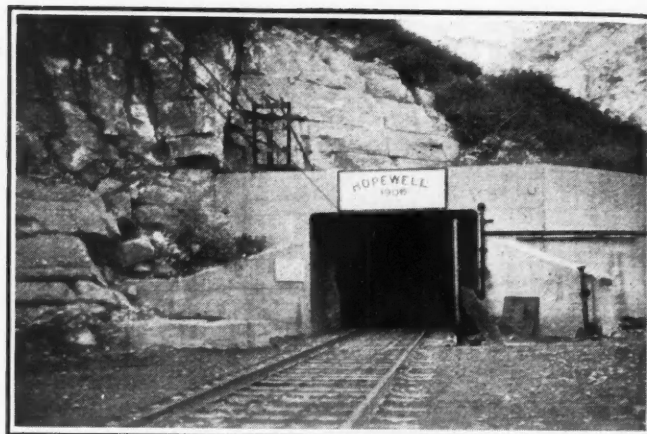
Track grades are limited to a maximum of 3 per cent, and grades are compensated 0.02 to 0.04 per cent for each degree of curvature, dependent upon the length of grade. The maximum curve adopted is 24 deg. (239 ft. radius). This is exceeded in a few instances, and as high as 34-deg. curves have been installed. No. 7 turnouts have been adopted and manganese-steel tipped switch points and solid manganese steel frogs are used. Main haulage tracks are 75 lb. steel and in some instances 90 lb.; dump and pit tracks, 60 lb.

Three shovels are in use, one Marion 300, long-boom revolving shovel and two Osgood 120, 5-yd. railroad shovels equipped with 4-yd. dippers. The Marion shovel is equipped with an 8-cu.yd. dipper, weighs 350 tons, dumps above rail 56 ft. and cuts 200 ft. width at 40-ft. elevation. The gage of shovel tracks is 36 in.; the two tracks of 90-lb. steel supporting the shovel are 26 ft. apart. The railroad steam shovels weigh 133 tons; dump above rail, 19 ft.; width of cut at 8 ft. elevation, 74 ft.; length of boom, 34 ft.; length of dipper handle, 24 ft. Both Osgood shovels have been equipped with caterpillar tractors. All shovels are steam driven and both shovels and locomotives use oil fuel.

TWO TYPES OF LOCOMOTIVES USED IN SWITCHING

Two types of switching locomotives are in use, 0-4-0 and 0-6-0, two of the former and four of the latter. The small locomotives weigh 50 tons on the drivers and the larger 82 tons. Locomotives are equipped with superheaters and ET automatic air equipment. Western Wheeled Scraper automatic air-dump cars are used. The equipment consists of twenty 25-cu.yd. (place measure) capacity cars, seven 26 cu.yd. and three 20 cu.yd. In addition six 40-ft. flat cars and six 40-ft. coal cars are in service for auxiliary purposes. Drilling equipment consists of three Keystone churn drills equipped with 2,000-lb. tool strings and 6-in. bits. In addition, Sullivan DP-331 rock drills are used for 20-ft. toe holes and jackhammers for mill-hole and bulldozing work. The deep churn-drill holes as well as toe holes are sprung before finally charging. In diorite 50 per cent gelatin powder is used; for rock within the fire zone 35 per cent powder, and outside of the fire zone, 50 per cent powder is used.

Early operations on the United Verde were compacted to the extent that the mine and reduction plant were closely co-ordinated in position and operated almost as a single unit. The rich near-surface orebodies, of great extent, furnished a convenient and abundant ore



Portal of Hopewell tunnel. Standard-gage track

supply. Mine methods developed around the square set and fill system. The topographic environment prevented convenient disposition of the surface facilities and resulted in a condition that required a radical readjustment. The occurrence of mine fires and the settlement of the surface due to consolidation of the stope fills interposed additional complications. Thus a complete reorganization became necessary. This resulted in the placing of the smelter at Clarkdale, the abandonment of the old smelter and mining plant, and the reorganization of the access to the mine and the construction of two mine plants. All of the new work was planned on a scale commensurate with the size of the ore deposit and was made as permanent and efficient as could be done. The prospective long life of the property justified a large capital input and the use of materials and equipment insuring long life and maximum economy in maintenance and operation. The plant and underground development are therefore of special interest to mining engineers.

Major development workings are in the footwall country rock, which is stable and is generally "good ground." The mine is served by two adits, one at the 500 level and the other at the 1,000 level (Hopewell tunnel). The former affords access for workers, timbers, and underground supplies. The mine shops, change house, and air-compressor equipment are grouped near the portal. The latter serves as the outlet for the ore. The switching yard for the ore trains and transfer bins for loading the smelter ore trains are at the portal. Two underground shafts, No. 6 and No. 5, serve the different levels of the mine, the former being used for handling men, timbers, and supplies and the latter exclusively for handling ore. Waste for filling is moved downward from the open pit through raises and is distributed horizontally by trains to short waste raises extending to individual stopes. The deepest mining level is 2,100 ft. Sinking has reached a depth of 2,500 ft. The level interval above 1,000 ft. is 100 ft. and below the 1,200 level the interval is 150 ft. A 200-ft. interval is considered uneconomic and inconvenient for stoping.

DIMENSIONS AND EQUIPMENT OF MAIN OPENINGS

The 500-ft. adit is 8 by 9 ft. in the clear, 1,600 ft. long, timbered with 10 by 10-in. Oregon pine timber. All timbers in the adit are gunited $\frac{1}{2}$ in. thick for fire protection. The adit is equipped with standard-gage track, 60-lb. rails, and in addition a third track provides for 18-in. gage cars. The Hopewell tunnel is

10 by 13 ft. in section and 7,000 ft. long. Part of the tunnel is timbered (2,700 ft.) with 10 by 10-in. Oregon pine, 5.5 ft. centers; posts 9 ft. high, battered to give 10 ft. clearance at the cap and 12 ft. at the sill. It is equipped with standard-gage track, 75-lb. rails. No. 5 shaft (Fig. 2) is a three-compartment concrete-lined shaft; skip compartments 5 by 5 ft. and a manway compartment 4 ft. 4 in. by 5 ft. No. 6 shaft (Fig. 3) is a three-compartment shaft; a cage compartment 8 by 13 ft.; counterbalance compartment 3 by 4 ft. and a manway and pipe compartment 4 by 9 ft. 4 in.

Two additional shafts, No. 3 and No. 4, connecting with the surface but without hoisting equipment, serve for ventilation. No. 3 shaft has been stripped of timbers below the 1,200 level and is used as a ventilating raise. No. 4 shaft has also been dismantled and is used for ventilation.

Both adits are incast. A No. 15 Sirocco fan, 90 in. in diameter, driven by a 400-hp. a.c. motor, is placed

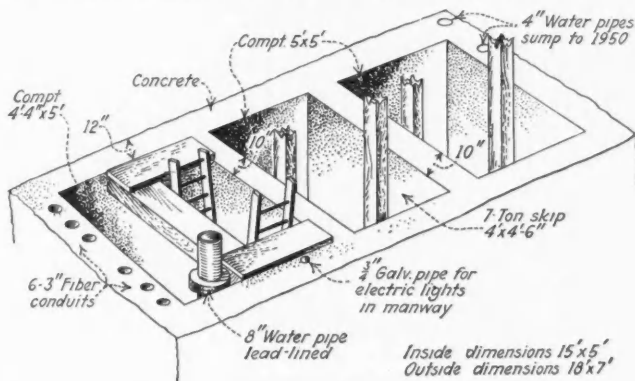


Fig. 2—Horizontal section of No. 5 shaft, with dimensions

on the 1,000 level close to No. 3 shaft. The fan draws air from the 500-ft. adit through No. 6 shaft. The fan forces the air down through an incline raise to No. 3 shaft, which is bulkheaded at the 1,200 level. Above the bulkhead No. 3 shaft is an auxiliary upcast, but below the bulkhead it is used to carry the air down to the lower levels. Doors at each level control the amount taken off. The air circulates through the stopes and is eventually upcast through No. 4 shaft.

Drainage is not a serious problem. Above the 1,000 level all mine water is removed through the Hopewell tunnel, where it is passed through a series of troughs containing scrap iron. Below the 1,000 level, all water is collected in a sump at the 1,950 level and pumped by an Aldrich quintuplex pump, operated by a 100-hp. a.c. motor, to the Hopewell tunnel level. The average flow is 105 gal. per minute.

HOISTING EQUIPMENT

The capacity of the ore hoist for three shifts' operation is 5,000 tons, and the maximum depth of No. 5 shaft will be 3,000 ft. The hoist station is concrete lined, 48 ft. 4 in. by 83 ft. 3 in., the sheaves being placed about 200 ft. above the hoist station, which contains a motor-generator flywheel set, switchboard, slip regulator, double-drum hoist, oil accumulator, and signal apparatus. The Ilgner-Ward Leonard system of load equalization is used. The hoist is of the double-drum, single-reduction geared type; drums are 10 ft. diameter by 5 ft. face; maximum hoisting speed is 1,000 ft. per minute; the rope is 1 1/8 in.; the weight

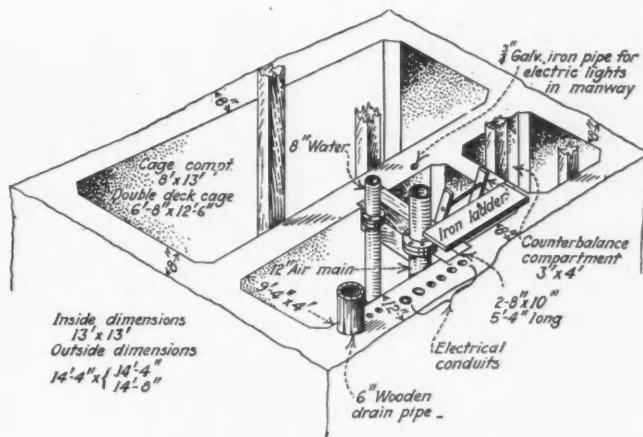
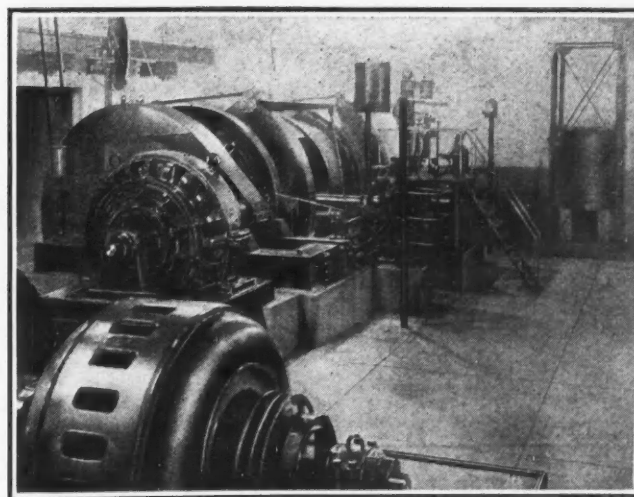


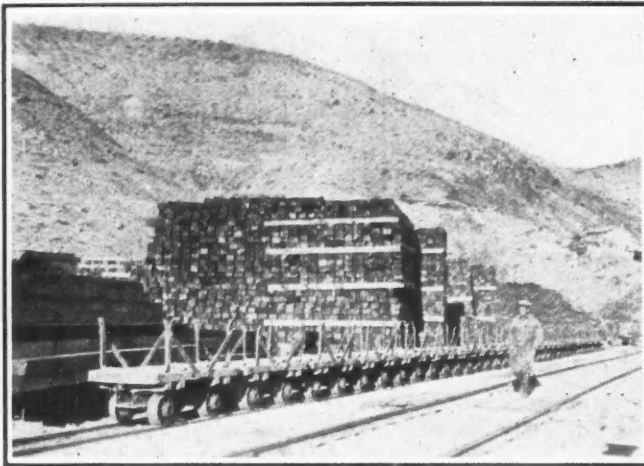
Fig. 3—Horizontal section of No. 6 shaft with dimensions

of skip 12,000 lb., and the weight of load 14,000 lb. The post brakes are set by weights and released by oil pressure cylinders. The drum shaft is connected to a cut-steel gear which is driven by a pinion connected by flexible coupling to a 650-hp. d.c., shunt-wound, Westinghouse motor. The motor receives its current from a 600-kw., 500-volt, d.c. generator. A 700-hp., 2,200-volt, a.c. slip-ring motor drives the generator and 19-ton flywheel. A 250-volt, 7.5-kva. exciter is directly connected to the motor. The hoist motor is operated by a faceplate field controller. The induction motor is controlled by a liquid slip regulator activated by a torque motor. A mechanical overwind device is geared to the hoist. Limit switches are provided to limit the skip travel in the shaft.

The service hoist at No. 6 shaft is housed in a reinforced concrete-lined chamber 44 by 45 ft. with an adjoining chamber 28 by 22 ft. The smaller chamber houses the direct-current generators which supply the direct current used underground, principally for haulage. The hoist is of the combination drum and reel, single-gear reduction type. The reel carries a 0.5 by 5-in. flat rope to which is attached the 31,600-lb. counterbalance. The double-deck cage, 17,400 lb. weight, deck dimensions 6.75 by 12.5 ft., is attached to a 1.75-in. hoisting rope which is carried on a 12-ft. diameter by 6-ft. face drum. The present depth of the shaft is 2,400 ft. The maximum load carried by the cage is 15,500 lb. and the hoisting speed is 800 ft. per minute



Hoist at No. 5 shaft, United Verde Copper Co.



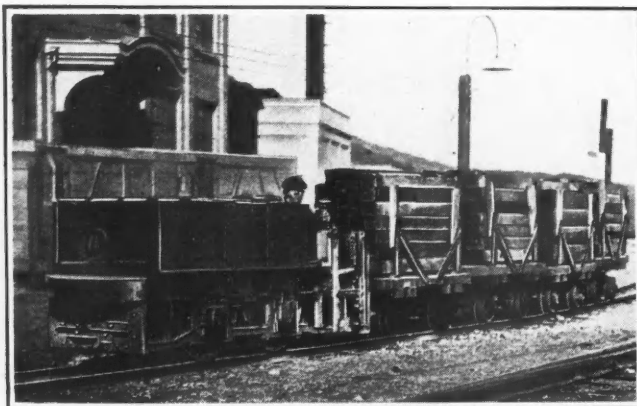
Prepared timber in storage. Timber cars ready to be loaded

maximum. The cage will accommodate 125 men. The 350-hp. motor operates at 2,200 volts and is provided with magnetically operated primary reversing switches and liquid rheostat speed control. Overwind and over-speed devices are provided as well as equipment for failure of current. Hatchway limit switches provide against overwind and a centrifugal governor prevents overspeeding. This hoisting installation is complete and every reasonable precaution to provide safe operation appears to have been taken. The cage is of such size that all mine supplies can be loaded directly upon the cage in cars without transfer. Men are handled expeditiously and comfortably. The overbalance feature insures a reasonable load upon the electrical equipment and economy in operation.

TRANSPORTATION

Special cars are provided for timber and drill steel. These are loaded at the timber yard or at the drill-sharpening shop and are hauled by electrical locomotive to the 500 level of No. 6 shaft. Men are hauled to and from the shaft to the change house in trains of closed standard-gage cars hauled by five-ton trolley locomotives. As the men are handled on company time, they are brought to and from the shaft with a minimum loss of time.

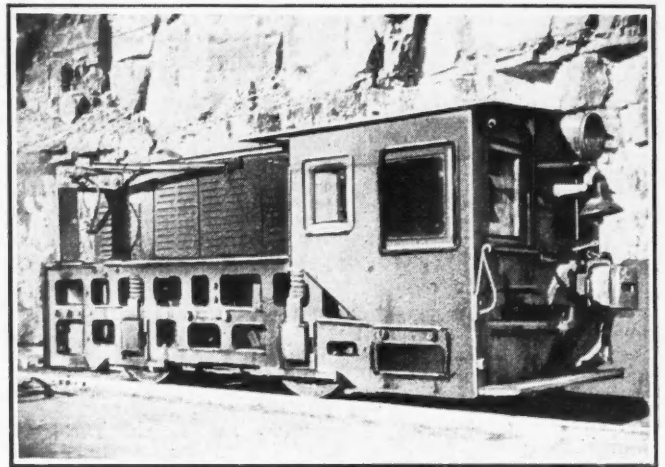
All ore delivered to chutes or cars is restricted to a maximum size. A grizzly opening 11 by 44 in. estab-



Type of storage-battery locomotive and special timber cars used on 500-adit level

lishes the limit for stope ores. Three car sizes have been selected for ore and waste handling, 18, 30 and 48 cu.ft. capacity. The first is a box-type car. The second, which is the new standard car adopted, is of the rocker or trunnion-dump type with spring drawbar. The large car is of the Granby type. Cars are equipped with 12-in. wheels, 3.25-in. tread, and solid roller bearings of the Sanford Day type are in general use.

A forty-ton, standard-gage, side-dumping steel car is used in the Hopewell tunnel. These cars are equipped with four wheel trucks and automatic air brakes, have a capacity of 625 cu.ft., and weigh 42,200 lb. The cars formerly used in this adit were twenty-five ton, weight 22,800 lb., equipped with air brakes, and of standard gage. The forty-ton car equipment is handled in ten-car trains. Three sizes of electrical locomotives are in service: three-ton Baldwin-Westinghouse storage-battery locomotives for service on intermediate levels and for handling supplies; steel six-ton Jeffrey trolley type, solid steel frame locomotives for operation on haulage levels, and twenty-five-ton Baldwin-Westinghouse locomotives for service in the Hopewell tunnel. The speed of the last-named type is 7.1 miles per hour,



Twenty-five-ton Baldwin-Westinghouse locomotive used in Hopewell tunnel

and the locomotives and cars are equipped with automatic air brakes.

Trolley service is at 250 volts direct-current. A No. 0 trolley wire is used for subhaulage and a No. 000 in the Hopewell tunnel. All trolley wires at less than 8 ft. above the rail are boxed in with 1½ by 8-in. boards. At the chutes, a hinged board 5 ft. long is provided for the protection of the loader. This closes the bottom of the inverted trough guarding the trolley wire. Three receiving bins, two for ore and one for waste, are provided in the Hopewell tunnel for handling the ore from the skips. Distribution is accomplished by an electrically operated (by the hoist engineer) movable hopper which swings through a horizontal angle of 120 deg. on a curved track. The discharge of the skips is received in the hopper, in front of which are three separate openings leading to the bins. A remote control enables the position of the distributing hopper to be shifted. The underground transportation system includes approximately 40,000 ft. of 18-in. gage and 10,000 ft. of standard-gage track. Mining methods will be discussed in a subsequent article.

To be concluded

Marketing of PRECIOUS STONES



CULLINAN DIAMOND (*South Africa*)



GIANT CARBONADO (*Brazil*)

THE TWO MOST VALUABLE GEMS EVER FOUND
(Two-thirds actual size)

How Diamonds, Rubies, Sapphires, Emeralds, Aquamarines Tourmalines, Jade, Garnet, Turquoise, Lapis Lazuli, and Amber Are Produced, Graded, and Sold

By George F. Kunz

Vice-president, Tiffany & Co., New York

MARKETING OF PRECIOUS STONES differs entirely from the marketing of other materials; first, because their value denotes wealth in small bulk, and, second, for the reason that a wonderful variety of precious stones exists, found in a wide range of territory, and they are obtained with difficulty—hence the search is uncertain. After they are found, the actual marketing depends in large measure upon the final shape given to them, as they require peculiar and special methods of treatment and preparation, suitable, often, to the fashions of the time.

The jewelry business flourished greatly in 1923, the records of which were only exceeded by those of the years immediately after the war. In all there was sold to the American public between Jan. 1, and Dec. 31, jewelry to the enormous value of \$450,002,751, an increase of over \$60,000,000 beyond the sales made in 1922, a satisfactory circumstance, as this showed a distinct increase for each month over the corresponding one of the previous year, with the exception of January.

The principal gem, the diamond, possesses small bulk and highly concentrated value. From the point of view of portability, it is possible to carry a million dollars' worth of precious stones in a waistcoat pocket, or

tightly grasped in the palm of the hand. In the African mines the yield from 1889 to the present time represents only about fourteen metric tons. Taking the diamonds from all other sources, there were possibly twenty-five tons produced in the last thirty-five years. This amount is so small that, put into weekly shipments, it would be about one and one-half tons a year, or say 30 lb. per week. Sapphires are profitably mined in Montana, but the entire yield from the discovery in 1900 to the present time does not represent more than one or two tons.

In Burma, rubies are mined and marketed through a company in London. Their yield does not represent more than a ton or so at most.

Cutting of the various gems is divided into entirely different professions. Diamond cutting is the principal industry in Antwerp and Amsterdam; some diamonds are cut in Paris and also at Saint Claude, in the Jura, and the art of cutting diamonds is practiced to a slight extent in Germany, but to a much larger extent—many of the finer gems—in the United States.

As not long ago the number of diamond workers in Amsterdam fell from 10,000 to 6,000, it was rumored that 4,000 had emigrated to Antwerp, but Henri Polak,

who occupies a prominent place in the diamond industry of Amsterdam, considered this to be erroneous, and that at most four or five hundred had migrated.

The output of the great diamond mines is now controlled by agreement. The material is offered by the Diamond Syndicate in London to cutters, in lots worth from \$50,000 to several hundred thousand dollars each. This is the result of legitimate mining, but many desultory stones from British Guiana, from the various river diggings in South America, and some from the Congo districts and from Australia and Borneo find their way to the European cutters, and are sold without a definite fixed standard, generally close to or sometimes in excess of prices offered by the Syndicate.

The rubies of Burma are mined by the Ruby Mines, Ltd., and then sent to London, where they are sold either in the rough or parcelled out to gem cutters, who use wheels which are charged with emery and carborundum—not with diamond dust, as are the wheels that cut the diamonds. These find their output principally through the Ruby Mines, Ltd., itself.

The blue sapphires found in the Yogo Valley, Fergus County, Mont., are controlled by the New Mine Sapphire Co., Ltd., of London. The finest stones are cut partly in London and partly in Paris; and many fine stones and the inferior stones are cut in the French Jura. Inferior specimens are sold in parcels, many calibre stones, and the very thin and poorer stones are cut principally in Switzerland, and from there distributed, being finally used for watch jewelery.

Beauty, durability, portability, and rarity are the four essential qualities that make a stone precious. This applies whether the material is transparent, as the diamond; translucent, as the opal, the cat's-eye, star-sapphire, or moonstone; colored, as the emerald, ruby, sapphire, alexandrite, aquamarine, tourmaline, or many others; or opaque, like lapis lazuli, malachite, or other stones.

Though all precious stones have a certain value, it is the finer gems that not only command the greatest price at all times, but are generally more salable and transferable. There is no other commodity that possesses this value at all times, and can be as easily carried and transported. In times of war or revolution the precious stone is the only article of great value that can be carried without observation. The following tables give the extreme values of an ounce and a gram of the various precious stones.¹ The first table gives the value of the extremely perfect gems; the second, that of stones of fine quality but not exceptional:

Table I—Comparative Values of Natural Precious Stones, Exceptional Specimens

Stone	Carat	Gram	Ounce Avoirdupois	Ounce Troy
Emerald.....	\$6,000	\$30,000	\$850,500	\$933,150
Ruby.....	4,500	22,500	637,875	699,862
Sapphire.....	2,000	10,000	283,500	309,015
Diamond, green.....	7,000	35,000	992,250	1,088,975
Diamond, red.....	8,500	42,500	1,204,875	1,321,965
Diamond, blue.....	6,850	34,250	970,987	1,065,343
Diamond, white.....	3,500	11,500	326,025	357,707
Twenty-grain pearl.....	20,400	100,000	2,835,000	3,090,150
Ten-grain pearl.....	2,600	10,000	283,500	311,150

Table II—Comparative Values of Natural Precious Stones, Fine Quality Specimens

Stone	Carat	Gram	Ounce Avoirdupois	Ounce Troy	Kilogram
Emerald.....	\$1,000	\$5,000	\$141,750	\$155,525	\$5,000,000
Ruby.....	1,000	5,000	141,750	155,525	5,000,000
Sapphire.....	500	2,500	70,875	77,762	2,500,000
Diamond.....	700	3,500	99,225	108,897	3,500,000
Ten-grain pearl (Base \$20).....	2,000	10,000	283,500	309,015	10,000,000

¹"The International Importance of Precious Stones in Times of War," by Dr. George F. Kunz, American Association, Chicago, Dec., 1920, from *The Scientific Monthly*, March, 1921, pp. 239-240.

An adequate idea of a large fraction of the annual sales of diamonds, pearls, and other precious stones can be had for the decade from 1914 to 1924 if we take the United States customs returns for that period. This gives us the surprising fluctuations beginning with the first year of the World War. The United States consumes 50 per cent more diamonds and precious stones than all the rest of the world.

To this must be added the cost of cutting of a part of the jewels imported, a duty of 20 per cent on the cut and 10 per cent on the uncut stones, and, finally, the 5 per cent sales tax which is paid by the ultimate consumer, thereby doubling these figures and giving a total of \$1,000,000,000—less than \$1 per capita per annum for the last ten years, yet a most fluid bit of wealth.

There is abundant evidence that in ancient Egypt the two highly prized minerals, lapis lazuli and malachite, were employed as currency, just as were gold and silver. This is treated of by the great Egyptologist Heinrich Brugsch-Pasha, who so long occupied an official position in the Khedival court and in the Cairo Museum. He writes:²

"It is a remarkable circumstance that in the enumeration of metals, precious and common, not only is the same ordering maintained by the Egyptians, but that among them two minerals are introduced, which were counted as costly stones, and in the earliest times of Egyptian history, as far back as the sixteenth century before Christ, were used as mediums of exchange and were therefrom defined in pounds and ounces, in units and fractions, as were the precious metals. These minerals are the dark-blue lapis lazuli and the green malachite. One quickly understands the significance of this as soon as one has recognized the principle followed by the ancient Egyptian of arraying series of minerals in accord with their colors, that is in the series white (silver), yellow (gold) dark blue (lapis lazuli), green (malachite) light blue (iron), red (copper) and dark gray (lead). This ordering corresponds in the main to the series of colors on a palette in the Berlin Museum."

SHIPPING, INSURANCE, DUTIES

In the shipping of gems it is important that the transportation should be safe. First, if mailed under *international postage* they should be insured, individually, or else covered by a blanket insurance policy. Second, they should be insured from the time they are mined until sold to the dealer. Third, in the matter of duties, which are so variable, it would be well always to look up the rates, which sometimes are export as well as import.

In shipping to a market it is very important that the stones should arrive in good condition, as the friction received on a journey of occasionally many thousands of miles will often abrade and fracture the mineral. Lightly wrapping in cotton or cloth and then tightly packing in a proper strong wood or tin case will insure satisfactory delivery. Paper occasionally becomes brittle or soft if wet or damp.

At no time in the world's history has the safe and economical transportation of precious stones been more highly developed and more fully realized than under British rule today. For a mere trifle of insurance, and at a maximum of speed, the shipper has an unexcelled service, which seems to be destined to preserve for a long time the primacy it owes to years of intelligent and conscientious endeavor, to aid and protect trade in every way from the miner to the merchant and to the ultimate consumer.

²Prof. Dr. H. Brugsch-Pasha, "Aus dem Morgenlande," Leipzig, n. d., p. 92.

U. S. Custom Returns on Diamonds, Pearls, Miscellaneous,
and Imitation Stones, 1914-1924

Year	Diamonds		Pearls	Miscellaneous	Imitations	Total
	Uncut	Cut				
1914.....	\$2,976,227	\$12,022,146	\$2,142,221	\$1,663,311	\$961,082	\$19,764,987
1915.....	7,047,945	13,140,548	4,309,837	1,124,344	898,656	26,451,330
1916.....	12,105,439	24,276,882	11,972,018	2,401,037	834,704	51,590,080
1917.....	14,189,684	18,416,570	4,898,406	2,234,608	1,167,399	40,906,667
1918.....	13,323,923	7,761,810	722,981	1,572,644	890,642	24,272,000
1919.....	21,300,139	64,222,942	11,541,000	6,629,554	1,579,903	105,273,543
1920.....	12,055,116	45,444,999	7,377,772	8,749,380	2,228,325	75,855,592
1921.....	2,693,171	26,338,455	4,538,803	4,528,803	1,235,897	39,345,129
1922.....	9,135,902	43,312,364	8,580,520	4,627,069	2,221,617	67,877,472
1923.....	8,467,532	52,020,098	7,961,215	6,351,852	2,743,436	77,544,134
	\$103,315,078	\$306,956,819	\$64,044,773	\$39,892,603	\$14,751,661	\$528,870,934
	\$410,181,897					

In striking contrast to the caravan or armed convoys that brought the diamonds of Brazil from the interior to the coast, the diamonds of the Belgian Congo, amounting to 250,000 carats a year, will be sent to the coast from Djoko-Punda, in the Kasai Province, by airplanes, the whole trip requiring but two days, whereas formerly it took from thirty-five to forty days to convoy them by boat along the Kasai and Kinshasha rivers.

The main insurance on jewelry and precious stones in the world today is carried by Lloyds Underwriters, London, England. They were the pioneers in insurance of this kind. It has often been stated that they will take any risk at the proper premium. This is very nearly true, about the only limitation being that the risk is not against public policy. Lloyds Underwriters are not hampered by extremely long forms of contract or severe limitations as to the kind and character of business which they write. The natural market, therefore, for insurance on jewelry, tended to go to Lloyds Underwriters.

There is no particular form of policy which would insure a gem miner against loss on stones mined and sent to cutters. In all probability, however, a gem cutter in Amsterdam can take out a jeweler's block policy to cover stock on his premises, and also shipments by a gem miner from South Africa to him. Even this policy is extremely elastic, and if a gem miner wanted some particular risk insured, which was not within the purview of the policy, an indorsement could be secured from Lloyds Underwriters covering the situation.

Nearly every large jeweler in most large cities carries a jeweler's block policy, which insures the shipment of diamonds and other precious stones to him from all parts of the world. So also most wealthy people, possessing a great deal of jewelry, have it insured, and the insurance attaches in any part of the world against all risks. Some American companies are now able to write and insure on personal jewelry. This generally does not include risks in case of war.

It is possible for a gem miner, upon mining gems, to take a separate policy, insuring the shipment of stones to any part of the world, with Lloyds Underwriters. This can be done by cable to London or arranged through a local insurance broker in almost any part of the world. The more popular form of insurance, however, for a gem miner to use, would be either a policy similar to the jeweler's block policy, or an open declaration policy—that is, one which runs for the entire year, a declaration being made of shipments during each month, which are reported to the Underwriters, and the premium determined accordingly, import and export rates being duly considered.

Precious stones are subject to duties, and of all import duties those of the United States are the highest. Indeed, some of them are so high as to be almost be-

yond the limit of safety as regards collecting them, for they greatly encourage the practice of smuggling, and the smugglers have worked out most ingenious methods for concealing the gems and also for their undervaluation. Fortunately, they usually ultimately awake to a realization of the truth of the Biblical adage that "the way of the transgressor is hard."

Another crushing impost is the 60 per cent demanded by the Union of South Africa for all diamonds found in the Transvaal.

In Brazil, in the principal State of Minas Geraes, a rough aquamarine, amethyst, or topaz pays a duty of Rs. 120\$000 a kilo, equal to \$13 a kilo (2.204 lb.) and a tax of Rs. 200\$800 a kilo on rock crystal. If precious stones are shipped from Minas to another state, or diamonds of another state are shipped to Rio de Janeiro to be shipped, a second duty is again placed upon them. Brazil is composed of many sovereign states, each of which has its own rights of taxation, over which there is at present no central government control. To get stones to the seacoast for exportation in general commerce, it is often necessary to bring the stones out of the state in which they are found and through one or more other states to a port of exportation. Wherever export tax laws exist it is inevitable that a great traffic in contraband is the result. A shipment has been divided into three parts and sent by different routes to the seacoast. The first paid an export tax, the second none, and the third may not only pay the export tax but a fine equal to the tax after it has been discovered to be contraband.

PRECIOUS STONE TRADING DATES FROM
THE EARLIEST TIMES

Undoubtedly one of the earliest markets for gems was that of Babylon, 4,000 B.C. The emerald, lapis lazuli, garnet, agate, Amazon stone, hematite, and jasper were the principal stones sold there. Contemporary with this were the cities of Egypt. Alexandria at one time was a great center; then Athens, Constantinople, Augsburg, and finally London, Paris, and now New York. Of the millions of old and antique gems that are known even down to a late Roman period, very few really precious gems are found in the collections of the principal museums.

The prosperity of any branch of commerce or trade is dependent upon the foresight and intelligence with which the product is handled, and this again upon the experience gathered in the course of centuries. Indeed, it may be said that this is even more the case with objects of luxury than with those things for which human necessities or the demand for raw products for human industries furnish a constant and almost unflinching market.

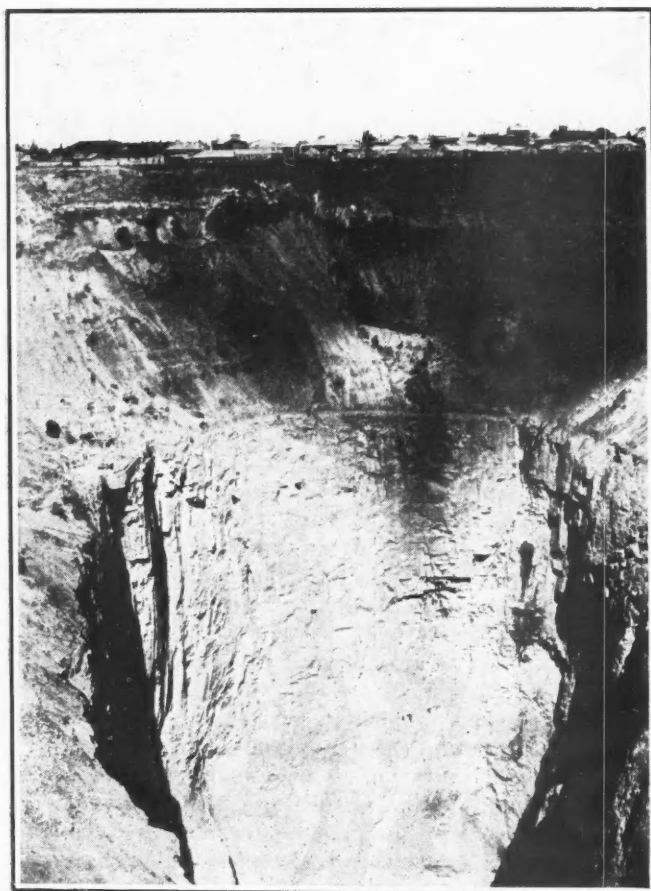
With objects of luxury, on the other hand, the distributing agencies must be activated by more or less

artificial means when the demand exhibits signs of falling off, and also when the discovery of new mines and deposits threatens to develop a supply in excess of the normal demand. Then it is that the industrial craft needs careful guiding. On the other hand, new deposits or new gems may cause an increased demand by their novelty. There are only few instances of gems being brought to the ultimate consumer direct.

Gem mining is more uncertain, more precarious, and generally less profitable than metal mining. Very few gems in bulk are found compared to metals. Also, success is largely dependent on a knowledge of public styles, and the subtle, proficient cutters for the material.

HOW THE DIAMOND OUTPUT IS SOLD

The most scientific and systematic marketing of gems has been shown by the masterly handling of the enormous South African diamond production. The patient and persistent amalgamation of the chief parts and then the groups of mines, planned and organized by that great Englishman and empire-builder Cecil Rhodes, involved years of struggle between the greatest rivals who have ever striven for domination in the diamond world, and has finally been solved by a pro-rata distribution of the diamond yield, so that the aggregate production may be equitably "fed" to the world's markets by a mighty organization, the London Diamond Syndicate. After carefully studying both the requirements of the diamond market and the just rights of the principal companies, it has been decided that the share of the chief mining groups shall be as follows: 21 per cent for the Consolidated of Southwest Africa (the old German group); 51 per cent for the De Beers mines; 18 per cent for the Premier mine, and 10 per cent for



Where most of the world's diamonds come from—the Kimberley "pipe," South Africa

the New Jagersfontein mine. A steady price has been maintained since 1888, with no fluctuations, adding greatly to the security and regularity in dealing.

The diamond represents fully four or five times the value of all the other precious materials found, including everything from the ruby, sapphire, the semi-precious rock crystal, agate, to and including amber. It is only by the use of the wonderful system of machinery and careful management and selling that diamonds can be produced so cheaply. They are so sparsely placed in the rock that in the weight of a load of blue ground 1,600 lb. on the average will contain only from 0.2 to 0.4 carat of diamonds.

The diamond, universally recognized as the "King of Gems," reached its primacy somewhat slowly. It was known, sparingly it is true, to the Romans, a few having drifted in from India in the early centuries of our era. As the full beauty of the gem could only be brought out by skillful cutting, the earliest to gain favor were those known later as "points natifs"; that is to say, crystals of such perfect shape that the natural faces of the octahedron sufficed, or almost sufficed, to display the brilliancy of the stone.

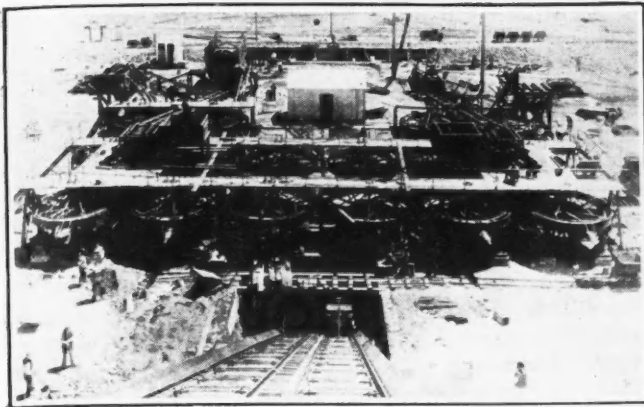
The gradual introduction of more perfect systems of cutting, progressing at first to the so-called "rose cut," with its limited number of facets on the upper side of the gem, the lower part being flat, and then, in the seventeenth century, to the full glories of the "brilliant cut," with its fifty-eight facets covering the whole of the gem, finally revealed the partly hidden beauties of the stone. By this time the diamonds of India were reaching Europe in ever-increasing numbers. The great pioneer in this importation was the indefatigable French gem-dealer Jean Baptiste Tavernier, the greater part of whose long life of eighty-five years was devoted to bringing diamonds and other precious stones from the Orient to the Occident—Louis XIV being his most magnificent patron—and taking others to the East.

The invention of diamond cutting has long been erroneously credited to a Robert de Berquem, of Brudges, on the strength of a statement made by a descendant of his, although he was doubtless one of the early improvers of the art. However, as early as 1300 we have evidence that the art was practiced in Paris by a guild of "diamond polishers" of whom the chief was a certain Herrmann.

The rapid increase in diamond sales due to the growing luxury and wealth was greatly helped by the discovery about 1730 of the diamond deposits of Brazil, and more than a century later, in 1867, came the discovery of the South African diamonds, which now constitute more than 90 per cent of the world's supply.

For many centuries before the great influx of diamonds into Europe began there had been a gradual but constant accumulation of these gems in the various courts of India, beginning in pre-Mohammedan times and attaining its climax in the brilliant development of the great Mogul Empire of Delhi and Agra. The downfall of one after another of these Indian states led to a redistribution of the royal jewels, in many cases to their importation to Europe by the dealers who were fortunate enough to secure possession of them. Before the customs returns of our day, we can gain but an imperfect and barely approximate idea of the total sum of these transactions.

Of the three great diamond fields in the world, the second to be discovered, Brazil, became productive about 1730 or a few years earlier, and careful estimates indi-



A diamond washing plant in South Africa

cate that the yield from that time up to the present has been well over 15,000,000 carats. Many large diamonds have been found there; the largest, if we reject the "Braganza" of 1,680 carats, reputed to have been discovered about 1740, is the "Star of the South," found in 1853. This weighed in the rough 254½ carats and gave a fine brilliant of 125½ carats. Now and again large diamonds turn up there, as in 1910, when one weighing 175 carats came to light. Still another large Brazilian diamond was the "Regent of Portugal," said to have given a brilliant of 215 carats and to have been discovered in 1775 (others say 1732, which seems rather unlikely). The "Braganza" is in reality either a white topaz or quartz.

However, at present Brazil is the only source for carbonadoes, or the amorphous black diamonds which are so successfully utilized for drilling; these come principally from the State of Bahia. The exports for the three years 1919, 1920, and 1921 have been respectively: 1919, 2,423 contos de reis (\$329,528); 1920, 3,017 contos (\$410,312); 1921, 2,616 contos (\$355,776). They are found by natives who pan them out of the river beds, are sold to visiting dealers or their agents, and find their way to the makers and sellers of diamond tools, or diamond tool supplies.

Total Diamond Production of Brazil, 1730-1907

Years	Carats
1730-1740	200,000
1740-1849	9,887,098
1850-1852	430,000
1852-1862	1,915,200
1862-1866	763,402
1866-1903	1,914,331
1903-1907	206,956
Total up to 1907	15,316,987

Of late years many of the Brazilian diamonds have been of the quality classified as "industrial."

The diamonds of the world probably represent a value of \$5,000,000,000, and it is likely that the actually accumulated gold amounts to somewhat less than \$8,000,000,000. There is nothing on the face of the earth that is less changeable than diamond. There is nothing more easily convertible, no commodity more easily transferable in any and every country in the world.

The immense diamond production of the De Beers group of mines in South Africa for the period from 1888 to 1921 will give an idea of the enormous output of these mines since their consolidation. It follows:

Number of Carats	Weight, Grams	Value	Dividends
1888-1911			
48,236,261½	9,903,097	£85,652,420	£32,154,563
1912-1922			
13,674,377½	2,734,875	43,100,628	20,105,000
Total	61,910,639	£128,753,048	£52,259,563

The value of product per carat is £2 0s. 8d.
The value of product per gram was £10 3s. 4d.
The value of product per ounce avoirdupois was £287 14s. 4d.

Thus, in thirty-three years since its organization the De Beers company has put out in dividends 11½ times the par value of its capital stock; that is to say, at normal exchange, it has paid the enormous sum of \$254,320,163 on a capital stock amounting to \$21,899,260.

From the total mass of diamond material there could be made a column measuring one meter on each side, and having a height of 3.56 meters, equivalent to 3.28 ft. on each side and 11.68 ft. in height.

Production of Diamonds in South Africa

Year	Production from Mines			Alluvial Diamonds		
	Carats	Value	Estimated Value per Carat	Carats	Value	Estimated Value per Carat
1913	4,944,946	£10,254,203	41s. 6d.	206,049	£1,120,227	108s. 9d.
1914	2,653,089	4,906,342	37s. 10d.	143,924	576,729	80s. 2d.
1915	2,131	3,887	36s. 6d.	97,678	392,196	80s. 4d.
1916	2,170,348	4,769,479	43s. 11d.	167,620	948,571	113s. 2d.
1917	2,710,041	6,659,721	49s. 2d.	182,992	1,041,776	113s. 10d.
1918	2,385,361	6,137,283	51s. 5d.	143,438	964,574	134s. 6d.
1919	2,366,744	9,960,614	75s. 9d.	209,589	2,270,548	261s. 6d.
1920	2,312,436	12,289,602	106s. 3d.	221,460	2,441,440	220s. 6d.
1921	671,483	2,308,758	68s. 1d.	151,552	894,960	118s. 1d.
1922	465,634	907,003	39s. 0d.	203,925	1,359,628	138s. 4d.
1923	1,815,225	3,748,705	41s. 3d.	244,406	1,657,800	143s. 2d.
Totals	22,597,438	£60,947,597	50s. 3d.	1,776,633	£13,138,179	140s. 10d.

The carat-value of the alluvial diamonds is shown by the table to be nearly three times as great as that of the diamonds from the mines.

The diamonds from the De Beers mines are sent to large or small cutters, which are often local, and then again the material is sent thousands of miles to be cut. For instance, in Ceylon and Brazil the cutting is usually crude, and the finer stones are frequently cut to great advantage in New York, London, and Paris, where the finest cutting in the world is done at present.

Totals for South Africa, 1913-1923

	Carats	Value
Mines and alluvial	24,374,071	£74,115,776
First half 1924	1,019,378	3,283,465
Grand total	25,393,459	£77,399,241

The total production of the world up to the present may be fairly stated as follows:

	Carats
India	2,000,000
Brazil	15,000,000
South Africa	90,000,000
Southwest Africa	5,000,000
Congo	1,200,000
Angola	260,000
British Guiana	200,000
Scattering	150,000
Total	113,810,000

Of this the Premier mine produced in 1903-1922 22,397,681 carats.

The diamond output of the Belgian Congo is becoming quite an important factor, as is shown in the following statistics:

Diamond Output of the Belgian Congo

Year	Carats	Year	Carats
1915	48,995	1919	275,000
1916	53,940	1920	315,000
1917	100,000	1921	174,000
1918	164,420	1922	250,000
		1923	444,782
Total			1,826,137

The production of the Angola mines for about the same period has been:

Year	Carats	Year	Carats
1916	1,300	1920	93,500
1917	4,100	1921	106,700
1918	14,000	1922	100,000
1919	48,500	1923	94,478
Total			462,578

In the period from April 1, 1900, to June 30, 1920, British Guiana has furnished the following considerable quantity of diamonds:

Stones	Weight, Carats
1,747,618.....	316,194½

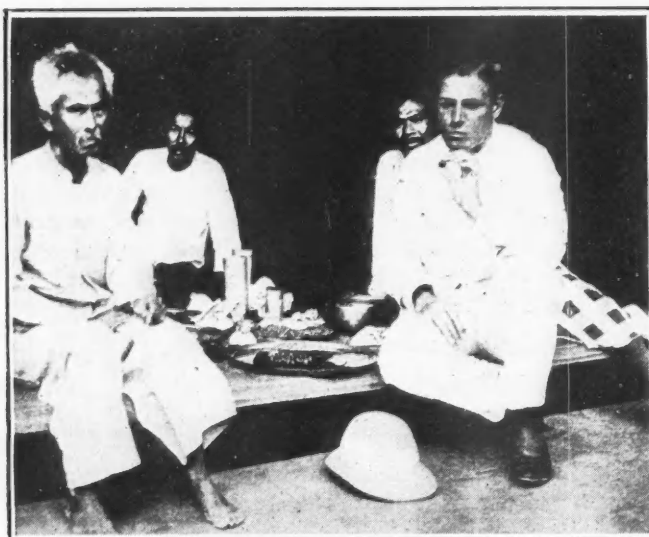
In 1920 they came from four principal river deposits:

	Stones	Carats
Mazaruni.....	75,909	14,944½
Puruni.....	4,240	1,045½
Cuyuni.....	15,702	1,920½
Potaro.....	12,740	249½
Total.....	98,591	18,159½

Fifty thousand persons visited the Mazaruni River district in that year, and 5,000 tons of stores was taken into the district. The region contains an area of 4,000 square miles, of which 350 have been proved by exploration to be diamond bearing.

The yield of British Guiana has increased rapidly since 1920, the output being: 1920, 28,000 carats; 1921, 106,520 carats; 1922, 159,426 carats; 1923, 214,385, valued at £1,032,585. This makes a total output of 825,525 carats from April 1, 1900, to June 30, 1923.

The initiation of an air service in British Guiana is seriously proposed, and the reports received by the West Indian Aerial Transport Co., Ltd., have been very en-



Buying and selling gems in a Burmese market

couraging, especially as to the Georgetown-Bartica-Karafarn route. It is recommended that the government keep control of any flying operations carried on within the colony.

Carbonado, the opaque sister of the diamond, possesses the greatest tensile strength of any natural substance. Its lack of beauty is compensated for by its wonderful tenacity. With it rock has been drilled more than a mile, virtually about twice the depth of the deepest diamond mine.

Besides its wonderful beauty, the diamond is the hardest substance in nature or art, and has industrially a thousand uses for engraving, polishing, drawing wire and acting as a fine abrasive in sawing exceptionally hard substances.

In the cutting of diamonds, quite frequently in Europe, a reputable cutter can obtain up to 80 per cent loan on a parcel of diamonds, running from \$150,000 to \$200,000, it being understood that the moment the diamonds are cut they advance in value and make a better security for the banker.

BURMA PRODUCES NEARLY ALL THE RUBIES OF COMMERCE

Rubies of pigeon-blood color are derived from the mines of Mogok, in Upper Burma; there is another though much less important occurrence in Upper Burma in the Sagin Hills, near Mandalay. Other ruby localities are in the provinces of Chantabun and Krat, in the neighboring country of Siam, but the Siamese rubies are of a brownish-red color, and are much less precious than the Burmese, though the Siamese sapphires are far superior to the Burmese. Burmese rubies bring from two to ten times the value of the dark-hued Siamese ruby. The mines of Burma have been mined for many centuries and were visited by Tavernier in the seventeenth century, who traded for rubies the emeralds of Peru which were looted by the Spanish from the Peruvians and sold to French dealers. These very emeralds, after having been for three centuries owned by Burmese rulers, were a second time looted from King Thebaw's treasury by the English when they captured it and are now in the Indian Museum in South Kensington.

There are many varying phases through which the ruby passes in trade, the trading being done either in the Burmese and Indian markets, or else in that of London. The most recent reports, for 1922 and 1923, reflect a general tendency of depression, with occasional favorable reactions. In the former of these years rubies were sold to the value of £45,372, compared with £33,507 for 1920-21, a notable increase. There was a better demand in London, and the trade in Burma and India was fair. In 1923, although £62,600 was realized for the rubies sold, the heavy working charges absorbed £58,155, and from the balance £10,152 had to be deducted as government royalties, making a net loss of £5,707 for the year.

The total output of the ruby mines for the last thirty-five years amounted to approximately £1,750,000, and in addition the native miners would in the same period have found stones to about half that value. The company's output last year was valued at about £54,000.

SAPPHIRE OF QUEENSLAND SOLD BY GOVERNMENT

The importance of the Anakie sapphire fields, in Queensland, Australia, is brought out by the records of production from the earliest years, 1892 and 1893, to the present time. During the two years just noted the value of the product was about £4,500, but the output steadily increased, until the figure of £43,400 was reached in 1913, soon after which the slump due to the World War made itself severely felt. This was followed by a rapid recovery to culmination in a production of £65,830 in 1920. The total output of sapphires from the outset of working up to the end of 1920 was £440,140, or well over \$2,000,000.

Immediately prior to the introduction of the present system of selling, by which the Queensland Government acquires the total state's output of precious stones, the price being that obtained for such sapphires by the government, less the amount of commission and expenses in regard to grading, marketing and sale, the government made a trial of a less radical plan of relief. During the period this was carried on, about 287 mines received 95 per cent of the market value on the field, and they deposited about 1,468 oz. of first blues, valued at £7,394. At present, instead of 75 per cent, the miner receives 95 per cent of the market value on the field. So far as can be learned, private sales in 1922 amounted

to £27,626 of gem stones and £612 of mechanical stones. compared with £43,662 of gem stones and £5,277 of mechanical stones in 1921.

As the advances made by the government represent only a percentage, though a fairly liberal one, of the market value of the gem stones as revised each three months, both sides are guaranteed against loss. Though, however, few actual purchases have been made, the buyers have been forced to offer more than they would otherwise have done. An expansion of the scheme is now proposed, so that surplus stocks of sapphires can be forwarded to the London market, where an attempt will be made to sell the stones. To this end the miners have appointed a committee to go into details and negotiate with the Minister of Mines. At present only very choice gems are locally marketable at decidedly moderate prices.

SIAM CONTAINS VALUABLE SAPPHIRE DEPOSITS

In our day Siam is the great sapphire-producing country, and the precious stone deposits east of Chantabun, on the Gulf of Siam, are the chief trade centers. The area of these deposits covers some hundred English square miles. They were discovered about 1866 and have been more and more actively worked since then, an English company having conducted the work since 1890. The mines of Bo-Pie-Rin alone are said to furnish more than half of the sapphires annually found. Practically the entire world's supply is derived from Siam, Australia, and the State of Montana; Ceylon furnishes very much less than she did in times past.

The sapphire mine of Phailin, in Cambodia, near the Siamese frontier about 50 miles southwest of Battambang and halfway to Chantabun, was reported as long as forty years ago by a party of Burmese hawkers. They said that they had seen blue stones in the hands of the natives, who had no idea of their value. This story attracted some other Burmans and resulted in establishing the colony that is now engaged in exploiting the mine. It is stated that twenty years ago this little colony flourished under Siamese rule, and the district provided a certain prosperity for the inhabitants in spite of a frequent recurrence of cholera epidemics. Sapphires of the first water were frequently found, and they were sent by the grantee of the Siamese Government concession to Chantabun, where the principal native middlemen were trading, and thence to Bangkok, whence they were forwarded, still uncut, to London and Paris, where they were sold, after having been cut, as Siamese sapphires. Until recently, when the native authorities were forced to yield to the French, cutting was prohibited in Phailin, as this would have led to illicit traffic in the stones. Soon after the transfer of the province of Battambang to Cambodia in 1907, the yield of the mines began to fall off, and the long depression caused by the war was the *coup-de-grace*. The political change had not interfered with the trade of the sapphires with Siam, and for quite a time the little Burmese colony retained its political semi-independence. The gems are found embedded from six to ten feet deep, a stratum of alluvial clay resting on crystalline rocks of various kinds. Only the sapphires have commercial value.

What is claimed to be the richest sapphire find ever made in Ceylon, or perhaps in the world, was reported in 1924 from Pulmadulla, about 50 miles from Colombo. The stones comprise yellow, gold, purple, and blue sapphires weighing from 20 to 700 carats. Some of the stones have been valued at about \$75,000 rough

polished. One sapphire perfect in quality and color, and cut perfectly, sold for \$250 a carat.

Important quantities of sapphire have been found since 1881 or 1882 in the Zanskar district of Cashmere, India. It is related that the original discovery was due to an avalanche. The rock wherein the sapphires occur is a micaceous schist, with veins of pegmatite; here are found the sapphires associated with rock crystal, spodumene, lazulite, beryl, and tourmaline. They are often of fine color. In Burma also, besides the ruby corundum, a small proportion of sapphires occur at Mogok, their color being often a rich blue. In 1902, there were produced here 210,784 carats of rubies, 9,786 carats of sapphires, and 10,241 carats of spinels.

The greatest regular sapphire production comes from the mines operated in Fergus County, Mont., by the New Mine Sapphire Syndicate. The mining property owned by the syndicate has an approximate area of 1,550 acres, and covers the sapphire lode for an extent of



A Korean gem polisher at work

5½ miles. The property consists of a continuous series of eighteen lode claims, two of which have been worked to a certain extent for the last twenty years, occurring in a monzonite dike that is visible across the country, and as it is disintegrated it was treated by a long series of gopher holes. The sapphires were evidently from another older rock, as all are etched. During this period gems to the value of about \$4,000,000 have been placed on the market. For a stone of the best quality, prices having the wide range of from \$3 to \$300 a carat can be had. In 1919 there was found an exceptionally fine stone weighing 10 carats in the rough; it furnished a gem of 5 carats' weight, and realized £400 in London, or £80 per carat.

Emerald is one of the earliest known of precious stones. It was already well known to the ancient Egyptians, as well as to the Greeks. Indeed, Herodotus tells us the famous Ring of Polycrates was set with an emerald engraved by Theodore of Samos in the sixth century B.C., and later the Romans of imperial times prized it among their choicest gems. The earliest mines were in Upper Egypt, on the Zabara Mountains near the Red Sea, the emerald occurring embedded in mica schist. These mines were worked well into Arab times, and were rediscovered about 1830, but were found to be almost exhausted.

The principal emerald mines of the modern world are in the Republic of Colombia, South America, in the neighborhood of Muzo. During the past two years a great stock of emeralds was gradually accumulated here, and these to the value of several millions of dollars were sold direct by the Colombian Government to a syndicate of French jewelers, who proceeded to distribute them throughout the world. However, there are smaller mines, and there has always been a leakage from the great mines, and stones found there fall into the hands of visiting sellers and get to Europe.

GEMS FOUND IN THE VEINS

A great series of gems occur in pegmatite veins. They are of regular occurrence in many places, and are, at times, mined by companies organized for the purpose, but generally by prospectors.

In the United States tourmalines are found in Maine; they are frequently cut locally and then again sold to the Eastern cities.

Many fine aquamarines and some emeralds are found in North Carolina and California.

The pegmatite veins at Milford, Conn., produced a



An agate market in the Idar Valley, Germany

great quantity of green and yellow beryl. Those near the vicinity of Portland and Haddam, Conn., have produced an occasional beryl and some fine tourmalines. Most of these find their way to lapidaries in New York City.

In California, great quantities of tourmalines—red, green, and yellow—aquamarine, blue topaz, kunzite, and other similar minerals have been found in San Diego County. The finer gems are cut locally or shipped to New York. The red tourmaline, often weighing from an ounce to several pounds, meets with special favor in China, where it is carved and then sent again to the United States and Europe.

The Madagascar and Minas Geraes, Brazil, occurrences duplicate that of California except that the aquamarines are more wonderfully blue in color; tourmalines of various colors are found. Brazilian stones differ in the fact that more of the fine yellow topaz are found, single stones of white topaz sometimes weighing over 100 lb. each. These gems find their way to New York, London, Paris, or to the vicinity of Idar, Germany, where they are purchased, cut, and sent to the ultimate consumer.

The gems of the Ural Mountains come into the market principally through Ekaterinburg, where they are sold to dealers, who send them to the annual fair at

Nizhni-Novgorod, and to Moscow and Petrograd. The gem-carving industry at Ekaterinburg was founded in the latter part of the seventeenth century by Catherine II, who sent two Italians to supervise its establishment here, as the peasants in the early spring, before the crops can be placed, search actively for these gems and frequently cut them during the winter, thus providing themselves with a means of livelihood that many other rural inhabitants do not have.

Under the name of jade there are included two distinct minerals: jadeite, with a hardness of 7, crystalline, with an alumina base, and often of a brilliant emerald color, and nephrite jade, with a hardness of 6.5, a felty structure, and dark oily green color.

The jade of Burma is found in the vicinity of Tam-mow, and when mined is auctioned at the mines to Chinese merchants, who sit about the auctioneer, and with a gentle pressure of the hand signify an advance bid on anything that they are endeavoring to buy.

The jade market in Burma presents annually one of the strangest commercial spectacles, for here the entire quantity of jade extracted in Burma is gathered together and sold at a single day's auction. This attracts as buyers representatives of the leading jade-carving firms, several of whom come from Canton, where the green jadeite is cut, and the rest from Peking, Foo-chow, and Shanghai, whose specialty is white jade. All the stones, after having been carefully ticketed, are exhibited the day before the sale, so that they may be examined by prospective buyers. After the auctioneer has taken his stand in the middle of the crowd, a number is called out. Instead of a vocal response from the bidders, as with us, several men rush to the auctioneer and grasp his hands and wrists beneath the shelter of his wide sleeves. A moment of silence ensues, when all at once the auctioneer calls out a price and name indicating that the piece of jade has been adjudicated to this bidder. The transaction is consummated by means of secret bids expressed by hand clasps. This strange practice of bidding is quite common in the East elsewhere, and for other precious stones, and has been for many years. The stones are then taken by the buyers to their homes, principally to Canton, where they are cut and carved, and sold to local dealers, who in turn export them to New York, London, Paris, and other centers.

The jade production of Burma, which comes from the extreme north of the country, goes to China, and naturally enough the mining and marketing are in the hands of Chinese. The total product of jade of all qualities mined in the three years 1915, 1916, and 1917 was 1,303,818 lb., and the export value of that produced in 1917 was £67,502 (about \$328,000 at normal exchange).

The garnets (almandite) of India are worked in India and sent throughout the world, either faceted, as beads, or cut *en cabochon* as carbuncles. This same is true with the carnelian, aventurine, and agate. The precious garnets (pyrope) of Bohemia, found near Dlaschkowitz, occur in the alluvial washings in decomposed peridotite. These precious garnets are unusually brilliant. They are generally worked up in the vicinity, mounted locally, and then find their way throughout the world. The garnets in tabular form were extensively used in the early times of Rome, in the decoration of early Celtic ornaments, and at present form a great industry in India and Africa.

The black opals of Australia have for a quarter cen-

ture enjoyed high repute. The Lightning Ridge opal fields, whence so many of the splendid black stones have been taken, have recently shown signs of greatly decreased productiveness.

Black opals have been discovered at Titenbar, near Ballina, New South Wales. Other opal fields are being successfully developed in South Australia. The great obstacle heretofore has been lack of water, and this has lately been remedied, since the South Australian Mines Department has provided tanks and has also had wells sunk at several points. The opal field is in the Stuart's Range country, about 120 miles north of Tarcoola, in the Kaloogie (Port Augusta) section of the Great Western Railway. The maximum extent allowed a claim is 150 ft., and the title in South Australia is secured by registration, and payment of a fee of 2s. 6d., this securing a miner's right. It is said that black opal of good quality is found here, and with the better facilities now accorded, there are good prospects that the work, which has been irregularly pursued since 1916, will now be taken up more earnestly.

A new and promising field for gem opals in the State of South Australia was reported in 1916. This is known as the "Stuart's Range Opal Field," the opal deposits occurring about midway along the range, or ridge, which separates the basin of Lake Cadibarrawirracanna from that containing Lakes Woorong, Philipson, and Wirrida. For the greater part of the year these "lakes" are merely silt-filled depressions, dry and smooth; they contain water only for a short time after a heavy rain has fallen, which does not happen frequently in this dry region.

The opal material is the finest of modern time and is usually found in irregular veins and patches, inclosed in the sandstone and claystone of the Upper Cretaceous formation composing the ridge. Occasionally precious opal replaces the fossil remains of mollusks and bellerophones, as is also the case in the opal fields of New South Wales and Queensland. The thickness of the opal seams, which are inclined at all angles, ranges from as much as two inches down to an almost imperceptible streak; the deposit is very promising, and this discovery is sure to attract miners, in view of the success attained in this branch of mining in New South Wales and Queensland.

LAPIS LAZULI MARKET DATES BACK TO
BIBLICAL TIMES

Probably the first precious stones of value which were regularly marketed in the world were the lapis lazuli of Persia (both by Egyptians and Babylonians from perhaps 4000 B.C.; these mines have been continuously worked for over six thousand years); the turquoise (also by Babylonians and Egyptians, and in our New World, in Mexico, and the territory of our present Southwest), and the emerald (from Upper Egypt in at least 2500 or 3000 B.C.). Although written records are lacking, we have material proofs, in the jade or jadeite artifacts, both of the Old and the New World, that "prehistoric jade" was utilized for the arts in the earliest polished stone age. All this represents the earliest mining in the world.

Lapis lazuli, the sapphire of the ancients, has come from the vicinity of the Oxus River, in Persia, for more than 6,000 years. Originally it was probably carried on camel or horse back to the Euphrates, and thence to the sea and to Egypt. Another route, later utilized, was by camel and caravan to the Volga, and

then on to Moscow and Petersburg. However, one must remember that the lapis lazuli columns in the Cathedral of St. Isaacs in Petrograd, long supposed to be of solid lapis lazuli, are in reality only covered with a thin veneer of this mineral, the pieces being very carefully joined together. It was a favorite material used for imperial gifts by the czars, who owned the cutting works at Tsarkoe-selo, near Leningrad; at Ekaterinburg, in the Urals, and at Kolyvan, in Siberia.

The most important mines of lapis lazuli are those of Badakshan, near the source of the Kokcha, a tributary of the Oxus in the northeast corner of Afghanistan. The rough lapis lazuli from here was conveyed by caravan by way of Bokhara into Russia, or else through Persia. As with many precious stones, the places through which the material passed often became known as the locality where it was found, and thus lapis lazuli was asserted to have been found in Bokhara, China, and Persia. Another actual source was in the neighborhood of Lake Baikal, in Siberia. It appears evident that the lapis lazuli of the Egyptians and the later Romans was brought from the Media of the ancients by essentially the same routes as were later utilized for the transport of the material from Badakshan.

For all these centuries this material has been shipped every year in lumps usually of not over five or ten pounds each. A notable exception was in 1922, when one mass of 220 lb. was sent to be sold and cut up in New York, and with this a quantity of lapis lazuli weighing a total of 1,000 lb. failed to find a market here and was reshipped to Europe.

Value of the Production of Precious Stones in the United States, 1880-1923 (a)

1880.....	\$100,000	1895.....	\$113,621	1910.....	\$295,597
1881.....	110,000	1896.....	97,850	1911.....	343,692
1882.....	150,000	1897.....	130,675	1912.....	319,722
1883.....	188,750	1898.....	160,920	1913.....	319,454
1884.....	222,975	1899.....	186,220	1914.....	124,621
1885.....	209,900	1900.....	231,170	1915.....	170,431
1886.....	118,750	1901.....	289,050	1916.....	217,793
1887.....	163,000	1902.....	328,450	1917.....	131,012
1888.....	139,000	1903.....	307,900	1918.....	106,523
1889.....	188,807	1904.....	324,300	1919.....	111,763
1890.....	118,833	1905.....	326,350	1920.....	265,205
1891.....	235,300	1906.....	208,000	1921.....	518,280
1892.....	312,050	1907.....	471,300	1922.....	71,000
1893.....	264,041	1908.....	415,063	1923.....	60,000
1894.....	108,000	1909.....	534,280		
Total for 44 years.....					\$9,811,978

(a) Principally from reports of U. S. Geological Survey.

The turquoise of Persia, found in the old mines at Nishapur for centuries—indeed, for thousands of years—were finally not permitted to be exported unless mounted. This was to protect the home industry, and as a result the most beautiful stones are set in fine gold; those of the second quality in silver; a still lower grade in rings of tin, and finally the poorer ones in paper ornaments. Thus a tribute was laid on them before they left the country, and they are then sent all over the world. In the New World rich turquoise deposits were found around Los Cerillos and elsewhere, in the boundaries of our New Mexico and Arizona, and centuries before these states were constituted, turquoise was mined by the natives and artistically used as an ornamental stone in primitive jewelry. It is now sent to Eastern lapidaries or cut up by the owners of the mines.

With the exception of a sapphire mine of Montana, no other mine in the United States has been worked profitably continuously for a ten-year period, and only a dozen have been profitable while being worked from the initiation of production until the suspension of operations.

Amber has been known since the earliest times, and was a source of trade between the Phœnicians and the inhabitants of the Baltic region, where the amber is found. For a number of years amber has been a government concession, and it is mined and cut into many forms to suit the African, Chinese, Burmese, American, and other trades. It is usually yellow and white in Saamland. In Burma it is found either as a golden brown or of yellow color, and is generally manufactured in the form of beads and chains of 104 beads, frequently carved, and also as pendants, and is the most prized of all amber.

PRESENT JEWEL MARKETING PRACTICE

The diamonds of the world are sold through the London Syndicate, and are readily disposed of there to visiting dealers from London, Antwerp, Amsterdam, Paris and New York. The rubies and sapphires are probably sent to London and Paris for division, cutting and ultimate disposal. Many are cut in the French mountains. The rock crystal, agate, and lesser gems find their way to Oldenburg, or to Freiburg, in Baden. The garnets and many of the less valuable stones come to Gablonz and Ternau, Bohemia. A less quantity goes to Paris.

At regular intervals consignments of agates, rock crystals, carnelians, and other gems are sold at auction in the courtyard of an inn at Idar, Germany, where the cutters of the district are permitted to examine the material; indeed, it frequently happens that chips of the agate have been dyed so as to show the possibility of

utilizing it for many various types of ornament. This industry was founded in the sixteenth century by refugees from Rome, Italy, and Waldkich, in Baden.

That all diamond mines are not a success is evidenced by the fact that in August, 1924, in the Assembly of the Union of South Africa, C. A. Van Nickerk (Boshop) asked the Minister of Mines and Industries what mines in the Orange Free State were at present closed down; what were the reasons, and what was the approximate loss of income by the state owing to this action. The Minister replied that nine diamond mines were closed—namely, Blaauwbosch, Driekoppies, Ebenezer, Roberts Victor, Voorspoed, Monoastray, Orange Free State, and Transvaal Diamond Mine, New Thor and Theron; the causes being in some cases want of capital and in others dubious payability. As none of these mines were being operated, the measure caused no present loss.

In Arkansas there are only two men working at the Arkansas Diamond Co. Pike County mine, washing from loose material. In the three months of April, May, and June, 1924, twenty-nine diamonds were found, weighing 132.65 carats; twelve are of the most absolute white; four are yellow, thirteen brown. The largest stone weighed 40.22 carats; it is a flattened irregular octahedron and is the largest diamond as yet from the American continent. The second largest, weighing only 33 carats, of very poor quality, was found within one hundred miles of Toronto, Canada. The stone measures twenty-three millimeters in length, eighteen in width and nine in thickness. It is of the purest white material, its whiteness being that of a fine river stone.



Mina Ragra, in Peru

Photo by W. S. Black

Discussion

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Conflicts Between Agricultural and Mineral Claimants

THE EDITOR:

Sir—Permit some comment upon the article in your issue of Dec. 20, 1924, page 978, entitled "Conflicts Between Agricultural and Mineral Claimants." Mr. Favorite is a high-class official and very much on the job. His article is good and will no doubt be helpful to many mining men. Nevertheless, the fact remains that *there is a conflict between the mining laws and the Stock Raising Homestead Act, despite the fact that the latter reserves the minerals of the entered land to the government.* To explain:

Section 2322, R.S., provides that the locator of a valid mining claim shall have ". . . the *exclusive* right and enjoyment of all the surface included within the lines of their (his) location. . . ."

The italics are mine. Now, this statute was not altered, revised, modified, or amended by the Stock Raising Act of Dec. 29, 1916. Indeed, that act provides that the lands entered shall be "*unappropriated, unreserved public land.*"

Land is neither "unappropriated" nor "unreserved" if covered by a valid mining location, regardless of the mineral reservations in the Stock Raising Act. A mining location segregates public domain just as effectively as a homestead filing. The great trouble is that, whereas the homestead filing is a matter of exact and certain record in a government land office, the mining claim is not—at least not until patent is sought—and in the interval the government land office allows entries over the mining claim simply because it knows nothing about it. Moreover, under the existing laws it has no way of knowing. Manifestly, this is unjust to the miner and has more to do with the "disappearance of the prospector" than the general public is aware.

When a miner discovers mineral in place, monuments his claim, does his location work, records his notice on the county records (pity 'tis not on the land office records) he has done all the law requires him to do. He rests content in the belief that Uncle Sam's law means what it says. But too often here in Arizona he finds that his surface is patented as stock raising land without his even having had a chance to be heard in the premises.

The Stock Raising Act is a farce. It was based on a false theory—namely, that a family could make a living from a section of land. There is not a section in Arizona or New Mexico that is properly subject to designation under the act upon which a family can make a living. Meanwhile it does great injury to the mining industry by taking the prospector's domain from him.

Phoenix, Ariz.

J. E. BUSCH.

Marysville and the Barnes-King

THE EDITOR:

Sir—I note in *Mining Journal-Press* of Jan. 24 a news item relative to the dissolution of the Barnes-King Development Co. In this the statement is made, referring to the mines, "all of which are in the Marysville district." Two of the four, the original Barnes-King mine and the North Moccasin, are in the Moccasin Mountains, Fergus County, northwest of Lewistown, Mont.

The statement seems to reflect on the Marysville camp, which has a record of profitable operations by every mine that attained to the proportions of even a small mine, with or without milling facilities.

Why cannot the Barnes-King find a mine? The statement that the company has spent large sums of money would interest the stockholders. The quarterly and annual reports do not show much, other than traveling expenses. Money spent in a real effort—under competent direction—might bring results. The Shannon was first turned down when it could have been optioned for \$25,000 on eighteen months' time. Later, after others spent \$31,400 in "extensive development," \$5,000 of which was a payment on the property, the B.-K. company took it over at a cost of \$228,000 to the stockholders. And now they can't find a mine?

Helena, Mont.

L. S. ROPES.

The Origin of Diamonds

THE EDITOR:

Sir—In this day it cannot be expected that all engineers can read all technical and scientific journals. In consequence, at this time it is not inappropriate to call the attention of those interested in gem mining to an article recently published in the *American Journal of Science*, Series 5, Vol. 5, pages 400 to 402, 1923, by Prof. R. J. Colony, of the Department of Geology, Columbia University, New York City.

The stone examined was furnished by John C. Baragwanath, mining engineer of New York, who procured it at the Corrego Novo mine, in the Diamantina district, Brazil. The mine is of the upland or "chapada" type.

The article is entitled "An Unusual Quartz-Diamond Intergrowth." In it he describes a diamond which he has examined microscopically. He finds therein tabular crystals of quartz with the optical properties of the quartz which occurs in pegmatites; that is, quartz formed probably at a temperature below 870 deg. C. As you are aware, the origin through peridotite presupposes a temperature of over 1,200 deg. C. In the diamond were also small particles of chlorite-like mineral of undeterminable nature.

The data are most important, adding force to the opinion of those of us who have claimed a multiple origin for the diamond. The predominant position in the industry of the South African pipe mines has led

some observers to hold that all diamonds were in origin closely associated with extremely basic rocks. The occurrence of diamonds in diabases is well authenticated in Australia and South Africa. The observations of Mr. Chaper, a French geologist, in 1882, at the Indian diamond locality of Wajra Karur, near Bellary, are strongly suggestive that the gems there are of pegmatitic origin. Derby believed that the diamonds from São João de Chapada, a mine of the upland type, near the Corrego Novo mine, were derived from quartz veins containing an assemblage of associated minerals of pegmatitic affinities. He suggests that a white feldspathic clay band near by may be a decomposed pegmatite, the casual rock. Gorcieux, a French geologist, states that he actually found diamonds in the quartz veins.

The heavy minerals associated with the diamond in the Brazilian alluvial mines are also suggestive, although by no means conclusive evidence of a pegmatitic or related origin of the gems. The reported inclusion in Brazilian diamonds of gold, pyrite, topaz, rutile, quartz, clinocllore, and ilmenite by various geologists and petrographers may well be considered as corroborative evidence.

In conclusion, the article is of particular interest in strongly indicating that the diamond, like so many other metals and minerals of economic value, is a byproduct of the intrusion of rocks of both basic and acid composition.

SYDNEY H. BALL.

New York City.

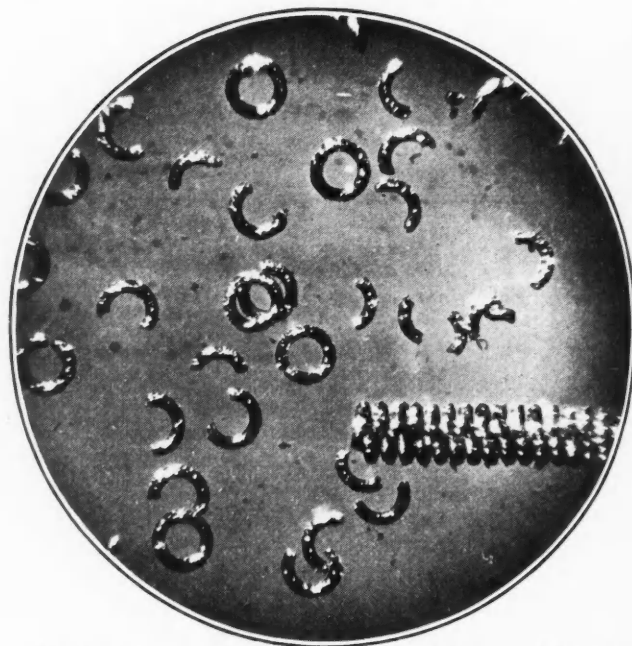
A Curious Occurrence of (or with) Platinum

THE EDITOR:

Sir—I have noted in your Jan. 10 issue correspondence by Ernest W. Ellis, of the Idaho Bureau of Mines and Geology, regarding "a curious occurrence of platinum" mixed with some grains of natural platinum recovered from a dredge in Oregon, the product containing some "small spring washer" shapes of bright metal which was not attacked by hot aqua regia and which otherwise resembled metals of the platinum group in appearance.

I inclose a photomicrograph of similar shapes which I have been able to produce in the laboratory without effort and which have the same physical and chemical characteristics as the products containing the platinum in Mr. Ellis' sample. My photomicrograph is taken with the same magnification—namely, 15 diameters. I have produced these rings by mashing the coiled filament of a 200-watt tungsten lamp. As most readers of this note doubtless know, the higher-powered tungsten lamps have the tungsten in the form of a helical coil. A portion of the tungsten coil with which I worked is also shown in the photomicrograph with the "platinum spring washers," which were made by merely crushing a portion of the tungsten coil.

I explain the presence of this tungsten in Professor Ellis' sample as due to the probable breakage of at least one tungsten lamp of the above description over the sluices of the placer mine or dredge in which the metal was recovered. Of course, the tungsten, which has a density of 18.77, would report in the same concentrate as the platinum (density 21.16) from the sand being washed. The almost exact duplication in the photomicrographs of Mr. Ellis and myself, together with the fact that solid forged tungsten is insoluble in aqua regia



Photomicrograph of rings produced by mashing the coiled filament of a 200-watt tungsten lamp.
Magnification 15 diameters

and has a very high density, seem to me to account for "a curious occurrence of platinum," mentioned by Mr. Ellis.

OLIVER C. RALSTON,

Superintendent, U. S. Bureau of Mines Experiment Station, Berkeley, Calif.

THE EDITOR:

Sir—Since the publication of my article on "A Curious Occurrence of Platinum" in *Mining Journal-Press* of Jan. 10 I have very fortunately received some valuable and interesting suggestions. I wish at this time to thank *Mining Journal-Press* for its prompt handling of the article and the interest and speed with which it drew replies. This further emphasizes the value of the "Discussion" pages.

Among the suggestions sent in are two of special merit. One is from Dr. James Lewis Howe, of Washington and Lee University, to whom the sample was sent originally, and the other from Oliver C. Ralston, of the U. S. Bureau of Mines, Berkeley, Calif. Dr. Howe says that in the manufacture of fine platinum chains the platinum is alloyed with iridium. Furthermore, these chains are made by winding the alloy around a rod the size of the links desired and then cutting the spiral lengthwise of the rod, thus forming a number of "spring-like washers," as Mr. Ralston calls them. The individual links are then joined together and soldered. The limiting small size of such links would be reached when the inside diameter of the individual link was less than the diameter of the wire from which the link is to be formed. A glance at the photomicrograph in the article of Jan. 10 soon assures one that the limiting conditions have not been reached as far as these rings are concerned.

In Mr. Ralston's article [which appears immediately above in this issue of *Mining Journal-Press*] he suggests the broken filament of a tungsten lamp as the source of the rings. His reason for reaching this decision is that the rings are the same size and shape and apparent gravity. Doubtless, Mr. Ralston misunderstood the article somewhat, as I carefully avoided the

use of any such terms as "platinum spring washers." It is barely possible this conception was gained from the caption "A Curious Occurrence of Platinum," which was not my choice of title, this prerogative falling to the editor. The title "A Curious Occurrence with Platinum" would have been less committal. I feel no apprehension whatever regarding the dredge operators and prospectors being "misinformed on the existence of a curious form of platinum group metals." Any prospector or dredge operator who knows something of the occurrence of platinum, knows well its rareness. One look at the photomicrograph would convince him that searching for the larger, brighter, and more numerous grains of platinum group metals is as far as he can go with the apparatus he carries in the field. On the other hand, if he does not see the article he will go on blissfully ignorant. Mr. Ralston's explanation does not account for the rods, which are of smaller diameter than the metal in the rings. One of these is faintly seen in the photomicrograph. The rod as shown is midway between the center of the photomicrograph and the right edge of it. It may be further located as lying between one of the rings and the six-sided grain of siserskite (a variation of osmiridium).

Rods from the tungsten lamp would be larger than these and show the same outward appearance as the rings. Of the two explanations the tungsten possibility is the more probable. Tungsten becomes very brittle after repeated heatings in the lamp, and the jar of the dredge plus the disposition of some operator on night shift would easily account for the rest. Further testing failed to prove either platinum group metals or tungsten. As the platinum reaction, however, is more delicate than the tungsten, it would appear that the amount to be tested was too small for a tungsten test and that Mr. Ralston's guess is correct. That it can be accounted for artificially and not naturally ends the discussion. I wish to take this opportunity to thank both Dr. Howe and Mr. Ralston for their valuable suggestions.

ERNEST W. ELLIS,
Idaho Bureau of Mines and Geology, Moscow, Idaho.

"Mining Practice for the Year 1924"

THE EDITOR:

Sir—In reading over the review of the literature on mining practice for the year 1924, that appeared on pages 105-108 of your Annual Review number, my attention was caught by the absence of reference to my joint paper with F. C. Houghten (Report 2,554, U. S. Bureau of Mines) on the cooling of mine air, in the section on mine ventilation. Quite possibly my opinion as to the importance of this report is biased, but that possibility can scarcely apply to the three important papers on the flow of air in mine workings, by Paul McElroy, and Greenwald (Reports 2,602, 2,621, and 2,647, U. S. Bureau of Mines), which are also omitted. The paper by Houghten, Yaglaglou and Sayers on effective temperatures (Report 2,563, U. S. Bureau of Mines) and that by Sayers on the effect of high temperatures on man (Report 2,584, U. S. Bureau of Mines) seem to me at least as important as the one on the kata-thermometer which is mentioned (Report, 2,565).

This caused me to run back over the review again, with the result that a mild sense of wonder was created as to whether the editor could possibly have declared a boycott on references to publications of the Bureau of

Mines. Out of seventy-eight papers which might be described as contributions to knowledge that were issued by the Bureau during 1924, only two are mentioned, the one referred to above and G. S. Rice's bulletin on rock-dusting (Bulletin 225, U. S. Bureau of Mines). Among the seventy-eight there are many that deal with metallurgy, fuel engineering, or petroleum, and so would not appear in a review of the literature of mining practice, but one marvels at the omitting of reference to the important monograph on flame safety lamps, by Paul, Ilsley, and Gleim (Bulletin 227, U. S. Bureau of Mines), which is certainly the most important publication on the subject that has yet appeared. Jakosky's three papers on the use of radio for underground communication (Reports 2,576, 2,599, and 2,651, U. S. Bureau of Mines) were the only papers of importance on the subject that appeared during the year, yet none of them are mentioned. Bowles' paper on mining limestone (Report 2,585) is also not cited.

It is quite natural that there should be a tendency to overlook government publications as contributions to knowledge, since there is a widespread (though, I think, generally mistaken) impression that government publications typically consist of routine administrative and statistical reports. As a matter of fact, the scientific and technical bureaus of the government are at least as prolific in their contributions to research as the universities are, in proportion to the number of persons engaged in the work. They have only limited funds for printing their reports, and they cannot publish them all; in other words, they have no good mechanism for bringing them to the attention of the general public, except through such notice as the technical journals are willing to accord them. Like the Mellin's food baby, we are advertised by our loving friends. While we do not doubt their love, it is only human to wish, at times, that we had some other means of advertisement.

Washington, D. C.

THOMAS T. READ.

Minas Pedrazzini

THE EDITOR:

Sir—I note the complimentary things you have said about the management I installed at the property of Minas Pedrazzini, Sonora, Mexico, as appearing on page 22 of your issue of Jan. 31, 1925. You, however, say "Antonio Pedrazzini is general manager and Morton Webber consulting engineer." The local management is in charge of W. F. Jahn and not Antonio Pedrazzini, whom I succeeded. It is due to Mr. Jahn's able co-operation with me that we have had the success as shown during 1924, and I am writing this letter in fairness to Mr. Jahn. I feel sure Mr. Pedrazzini will be as anxious to correct your error as I am.

MORTON WEBBER.

The Stock Raising Act Again

THE EDITOR:

Sir—It would be very gratifying to me to have *Mining Journal-Press* take the question of repeal of the Stock Raising Act, which is working a great hardship on the miner in the Western states and is excluding him very effectively from vast tracts of mineral lands. The mining profession is hazardous enough without this added discrimination against the mining interests.

Tyrone, N. M.

A. A. LEACH.

Consultation

Selective Flotation Methods

"I am looking for the latest information on the selective flotation methods of separating the mixed sulphides of lead, iron, zinc, and copper.

"What companies are using such a method on the entire tonnage, and is it because it is the most efficient process or because of the force of other considerations?"

"What is the general procedure used in such separations?"

"What book do you know of that is the most up to date on selective work? I have Rickard and Ralston, and have access to McGraw and have Taggart's 'Laboratory Manual.'

"What I am after is the best and latest practice on selective flotation, and if there is something better than Taggart's work, please use your judgment as to what to send me."

There are no books that are sufficiently up to date on the subject of selective flotation to do you much good. Taggart's "Laboratory Manual" is his latest book so far as we know, and nothing more recent has been published by anyone. Of course, numerous articles have appeared in *Mining Journal-Press* and other publications, but you have no doubt followed those.

Selective flotation is a great success for all or a major part of the tonnage at a good many milling plants. Among these are the Consolidated Mining & Smelting Co., at Trail, B. C.; the Bunker Hill & Sullivan, at Kellogg, Idaho; the Anaconda Copper Mining Co., Anaconda, Mont.; the Timber Butte Milling Co., Butte, Mont.; the International Smelting Co., Tooele, Utah; the Combined Metals Reduction Co., Bauer, Utah; the Tennessee Copper & Chemical Co., Copper Hill, Tenn.; the Ducktown Sulphur, Copper & Iron Co., Ducktown, Tenn.; the Old Dominion Copper Co., Globe, Ariz.; and the Moctezuma Copper Co., Nacozari, Mexico. These are only a few of the companies using selective flotation. The names of others may be obtained by referring to our news and editorial pages for the last year or two.

The general initial procedure is to float the mineral that can be most easily removed. To do this a minimum amount of flotation reagents is used and of a kind that has least effect on the mineral that it is not desired to float at first. Also, the machines are commonly crowded so that only the most readily floatable material will come off, the remainder being forced into the tailings. To the tailings are then added stronger flotation agents which will have the desired effect of removing the balance of the mineral. Longer time is then given for treatment in the succeeding cells. Also, regrinding may be practiced.

In some instances a mineral that is easily roasted may be subjected to this treatment before flotation, thus slightly oxidizing the surface and preventing the mineral from being raised in the flotation cell, although this complication is not ordinarily followed, nor is it necessary.

At the present stage of this work, the very best method to follow is to familiarize oneself with what is going on by a visit to some of the plants that are carrying on work of this kind. A great deal of information may be procured by talking to the officials in charge, and we feel sure you will find them approachable, providing your own plant is also willing to cooperate in the release of information.

Vanadium Ore Quotations

"We note that *Mining Journal-Press* quotes vanadium ores at \$1 to \$1.25 per pound on ores of not less than 18 per cent grade. We further find that another trade journal quotes the same ore about double. Please check this quotation for us."

Vanadium ore quotations are decidedly nominal. Our quotation attempts to state what vanadium ore of the grade indicated in the quotation is worth, although little if any supply can be had. A fair value can be figured from the price of ferrovanadium. Several months ago a reduction in the price of ferrovanadium was made to a nominal price of \$3.25 for crucible grade material. This price is doubtless being shaded in some sales. Deducting smelting charges and a margin of say 20 per cent for profit, the price of this grade of vanadium would be from 95c. upward.

At present the chief source of supply is controlled by the Vanadium Corporation of America by its ownership of valuable South American deposits. Other sources have not been fruitful in furnishing vanadium ores to the market. We are informed that a company known as the United States Vanadium Co. is about to start producing a sintered vanadium oxide containing about 52 per cent vanadium at a plant near Rifle, Colo. The ore used is one containing about 3 per cent V_2O_5 and is produced from some claims about 15 miles distant from Rifle.

Analysis of Commercial Titanium and Zirconium Minerals

"Please let me have the analyses of various commercial grades of rutile, ilmenite, zircon, and zirconium oxide, especially as quoted in your market letter."

The rutile of commerce generally assays about 93 per cent TiO_2 , according to the Titanium Pigment Co., Inc., New York; ilmenite will run about 52 per cent TiO_2 , and zircon assays 99 per cent $ZrSiO_4$.

Zirconium oxide has the following chemical analysis:

	Per Cent
ZrO_2	94.00
TiO_2.....	.30
Fe_2O_3.....	.10
SiO_2	5.00
Al_2O_3.....	.60
	100.00

No Domestic Outlet for Tin Ores

"Can you give us the names and address of firms buying tin ore in five- and ten-ton lots? This ore is of very good grade, but the deposit is small so far.

"Also, can you tell us if it is possible to get paid for platinum in a tin ore? We have not yet tested the ore for platinum, but it is claimed that it carries an appreciable amount."

At present there are no tin smelters operating in this country, all having been forced to close down owing to competition with English plants. The ordinary method of smelting tin ores does not recover the platinum, and you would not be paid for it. However, when the American Smelting & Refining Co. operated its plant at Perth Amboy, N. J., the tin was refined electrolytically, so it is possible that this company might have been willing to pay for a substantial content of platinum.

News of the Week

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

Summary

THE Consolidated Mining and Smelting Co., of Canada, has revised its custom ore-purchasing schedule to increase returns on the zinc content of zinc-bearing ores received at its Trail smelter.

For seven consecutive weeks, output of Joplin-Miami mines has been valued at more than \$1,000,000.

Many rumors have accompanied the marked decline in City Deep shares on the exchange in London.

Utah-Apex Mining Co. earned \$185,000 in January, this being more than its quarterly dividend by \$53,000.

The Chile Copper Co. has been sustained in its suit to recover \$269,710 in protested federal taxes.

The United States S. R. & M. Co. has acquired complete control of the Hammon Consolidated dredge interests in Alaska.

A thorough survey of the iron-ore situation in Michigan will be undertaken by the State Geologist.

Highway construction and auto-truck transportation are solving the haulage problem of isolated mines in Mexico.

Two more concentrators, the Euterpe and Ellis plants, in the Joplin-Miami district, have been burned.

New financing arrangements by the Union Minière are expected to raise about \$7,000,000.

Consolidated M. & S. Co. Alters Schedule for Complex Ores

Shippers Get More for Zinc—Millions Spent on Development of Metallurgical Process

The Consolidated Mining & Smelting Co. has amended for the benefit of producers "Schedule A," dealing with zinc ores and concentrates, which went into force on April 7, 1922, and was the first zinc schedule to become operative in Canada. Previously zinc in silver ores had been penalized if present in excess of 10 per cent. When the schedule was made, officials of the Consolidated company announced that it would be altered from time to time, but that for a period it was considered to be only fair that the independent operators should assist to some extent in reimbursing the company for the enormous outlay—said to be about \$3,000,000—that had been spent in perfecting a process for treating the silver-lead-zinc ores of the Kootenays. The result was that so far as the zinc content of the ores was concerned, the independent operators received very little, but, as the zinc ores of West Kootenay always contain an appreciable, and sometimes a large, quantity of silver, the operators were well satisfied to get this ore smelted without having to pay a penalty for the zinc. As the price of zinc advanced, shippers were paid appreciable sums for zinc as well as for silver content of their ore.

"Schedule A" is a complicated document, payment being based on the London prices for lead and zinc and the *Mining Journal-Press* quotation for

Quicksilver Mine Promotor Convicted Under "Blue- sky" Law

RECENTLY at Sacramento, Calif., R. A. Boggess was convicted of filing a false statement in an application before the California State Corporation Department to sell what purported to be gold notes of the Alpha Quicksilver Mining Co. Boggess represented that the net profits of the company in the years 1900, 1901, and 1902 were \$7,000 per month, which was proved at the trial to be untrue. Boggess admitted that the company had not made \$7,000 per month net profits during the first nine months of 1900. Although a permit was not given to Boggess, securities were sold in California and Eastern States, the sales totaling a large sum which was a total loss to the investors.

silver and on the amounts of the several metals contained in the ores; a further deduction of 3.6c. per pound of zinc is made to go toward reimbursing the company for experimental work in connection with the process. The amended schedule went into force on Feb. 16, and shippers estimate that for a 40 per cent ore or concentrate they will benefit by the amendments to the extent of about \$4 per ton. To a big shipper the amended schedule will have an important bearing on the profits.

"Million-dollar" Weeks Usual Thing Now for Joplin-Miami

Few Work Night Shifts—Much Drilling by Various Operators—New Shaft at Picher

Production in the Joplin-Miami zinc-lead district continues heavy, and for seven consecutive weeks the "turn-in" has been valued at more than \$1,000,000 per week. Though only 158 mills were in operations at last accounting, several others will be started soon, and it is believed that production will pass the 16,000-ton mark. It would easily exceed that now if the companies operating generally adopted night shifts. They are not doing this, however.

The Childress interests, which recently took a drilling option on 400 acres in the Waco, Mo., section of the field, are operating seven drills in that neighborhood. The American Zinc, Lead & Smelting Co. has taken a drilling option on the Freehold Oil & Gas Co.'s No. 4 mine. The Matthiessen & Hegeler interests have taken a drilling option on the Barnsdall No. 1.

The Underwriters Land Co. has started operating its No. 8 mine, known as the Waxahachie. The St. Louis Smelting & Refining Co. plans to begin production at the American Beauty mine, in the northwestern part of the Picher, Okla., camp, in the near future. The Admiralty Zinc Co. plans the removal of its mill on its No. 1 mine, in Century, Okla., to the Alamo lease, northwest of Joplin. Frank Childress, of Joplin, has taken a drilling option on the St. Joe lease, in the heart of the town of Picher.

Auto-truck Transportation Answer to Increased Pack Rates

Isolated Districts in Mexico Solving
Haulage Problem—Consider Mill
at La Chatao

W. H. Dudley, manager of the Oaxaca-Mexico Development Co., is spending some time at the property of the company near La Chatao, in the Sierra Juárez district near Oaxaca, Mexico. This is only a few miles from the Natividad mine.

The company is considering the erection of a concentrator of small capacity to treat the ores taken out in process of development. In the engineers' estimates they have encountered a condition which is giving all mine owners and operators at points remote from the railroad considerable concern: the high cost of "pack" freights. Formerly the rate for pack freighting was reasonable, but the influence of labor leaders and agitators seems to have reached the most remote points.

For example, the operators of the Guacamaya mine, in the Totolapam district, have to pay 65 pesos per ton for a two days' haul to Oaxaca, and when Mr. Dudley was seeking a basis for estimates on packing his machinery to the millsite the packers demanded 1 peso per kilogram. As far as the Sierra Juárez section is concerned, it is expected that the automobile truck road now being constructed will relieve this situation and bring the prices down to their old normal level of about 55 pesos per ton, if not considerably less.

The Tlacolula, Taviche, Ejutla, and intermediate districts are favored by having rail communication, with correspondingly low rates, but as the railroad from Puebla is a narrow-gauge road, with car-load limits of 10,000 kg., this factor must be taken into consideration in making estimates and arranging loads.

Mile-long Drift Will Connect Michigan Iron Mines

The McKinney Steel Co. plans to connect its Odgers and Tobin mines at Crystal Falls, Mich., with an underground drift. This drift will be about one mile long and will be next in length to the connecting drift between the Barnes-Hecker and North Lake mines, at Ishpeming. The new drift will be started from both ends. In addition to providing better ventilation, the company will learn much about the formations.

Tonopah Production Figures

The West End Consolidated Mining Co. reports a production of 75,500 oz. of bullion for January, valued at \$64,200. The Tonopah Mining Co. of Nevada reports shipment of 115,800 oz. of bullion, valued at \$109,175, from its mill at Millers. The company at this plant treats approximately 100 tons per day from the mine of the Tonopah Belmont Development Co. and about 50 tons a day of sorted ore from its own property at Tonopah.

United States S., R. & M. Co. Acquires Hammon Dredges in Alaska

THE Hammon Consolidated Gold Fields, operating three large gold dredges at Nome, Alaska, was recently acquired by the U. S. Smelting, Refining & Mining Co. The latter company had an interest in the Hammon company amounting to \$1,500,000, and by purchase it is now in complete control of the company.

At Fairbanks, Alaska, the Hammon Engineering Co. and United States company have participated on an equal basis in the examination and acquisition of placer ground suitable for gold dredging, but no construction program has been as yet formulated.

M. L. Summers, who has been operating superintendent at Nome, and H. R. Edwards, who has been in charge of the engineering work, will be affiliated with the U. S. Smelting company and will continue that company's work at Nome.

Tonopah Keystone Resumes Sinking in 200-ft. Shaft

The Tonopah Keystone Mines Co., the most recently organized company operating in the Tonopah district, in Nevada, resumed sinking its shaft on Feb. 16. This company was organized following the discovery of ore in the property of the West End Extension Mining Co., and acquired two claims adjoining the West End Extension Co. property on the west. Surface equipment was installed and a shaft sunk to a depth of 200 ft., when operations were suspended on short notice and without explanation. It is understood that sufficient funds are now available to prospect the property thoroughly.

The shaft is still in cap-rock and will be continued until the underlying formation has been penetrated, after which crosscuts will be driven to the north and south. J. C. Crumly is general manager of the company, Arthur Lowery consulting engineer, and W. Hales mine superintendent.

Smelter and Refinery at Mazatlan Projected by Americans

A smelting and refining plant will be built at Mazatlan, Mexico, according to reports. The project is to be directed and financed by Americans. The first unit will have a capacity of 150 tons of ore a day. Ore, concentrates, and bullion will be brought to the new smelter and refinery from Sonora, Sinaloa, and Nayarit, over the Southern Pacific of Mexico, at the start; and when the proposed extension of the Kansas City, Mexico, and Orient and the proposed railroad from Durango to Mazatlan are completed the plant will have a large territory from which to draw.

Two More Mills Burn in Joplin-Miami District

Ellis Fire and Broken Pump Cause
Curtalement in Crestline Area—
Will Rebuild

Two more concentrators have been lost by fire in the Joplin-Miami zinc and lead district recently. On Feb. 11 the mill of the Euterpe Mining Co., situated 2½ miles west of Baxter Springs, Kan., was destroyed by a blaze of unknown origin, at an estimated loss of \$100,000, covered by insurance. On Feb. 17 the Ellis mill of the Eagle-Picher Lead Co., in the Crestline, Kan., section of the field, was burned. The loss was estimated at \$75,000, partly covered by insurance.

The Euterpe plant was a new mill built on the site of the old Euterpe concentrator, which was lost by fire about a year and a half ago. Sixty miners were in the mine when the blaze was discovered, but they escaped without difficulty by means of a field shaft.

The Eagle-Picher Co. had completed the Ellis mill only a few weeks ago, spending considerable money on repairing and putting it in first-class condition. Besides the loss to the company, production in the Crestline camp has been seriously curtailed because the Eagle-Picher pumping plant at the Ellis had been the primary factor in holding heavy water down to a level of 192 ft. Dropping of a hopper full of ore on the pumping plant when the derrick burned has delayed the work of getting the pumps in operation again, and the water has risen enough to force several other mines in the field temporarily to stop operations. At the time of the fire the pumps at the Ellis were lifting about 4,000 gal. a minute. The mill will be rebuilt at once.

Callahan Zinc-Lead Finds Ore in Galena Mine

Referring to reports from Wallace, Idaho, that the Callahan Zinc-Lead Co. has opened a rich orebody at the Galena property, John Borg, president, says: "We have received a wire from General Manager Newton advising that a crosscut on the 800 level of the Galena property has cut 12 ft. of lead-silver ore. Latest assays for the full width of the drift-face were 14.7 per cent lead and 11.4 oz. of silver per ton. The successful development of the Galena mine will have an important bearing on the future operations of the company."

A. S. & R. Buys 50,000-Ton Dump

The Bingham Mines, Co., owning and operating the Eagle & Blue Bell, Victoria, and American Star mines, of Eureka, Utah, all of which are worked through one shaft, has disposed of a large pile of low-grade ore to the A. S. & R. Co. This dump is the result of many years of mining operations and contains approximately 50,000 tons, carrying gold, silver, and lead. The dump is conveniently situated with respect to railroad transportation and the cost of loading will be small.

Early Resumption in Kootenay Mines, in British Columbia

Van Roi Ready to Ship—Noble Five Mill Reconditioned—Consolidated M. & S. Buys Claims

An unusually wet January, with a total precipitation of 5.24 in. at Nelson, has enabled those mines that close for the midwinter months in the Kootenays, in British Columbia, to make an earlier restart than usual, with the result that already there is a considerable amount of actual and prospective activity in the district. The Van Roi mine, at Silverton, reopened early in February. Nearly 700 tons of ore was shipped during last year, and a considerable tonnage of ore was developed, so it is expected that the mine will make an even better production in 1925.

The Slocan Consolidated Silver Mines has decided to reduce its capital from \$300,000 to \$200,000. The company is reopening the Wellington mine, which adjoins the Whitewater mine, at Retalack. Slocan Silver, together with Standard Silver-Lead Mining Co., also is developing the downward extension of the oreshoot at the McAllister mine from a raise in the tunnel that was completed last summer. A considerable amount of ore has been developed, and it is expected that shipping will be started in the summer.

A Vancouver syndicate has bonded the Noble Five mine, on the north fork of the Lardeau River, for \$250,000. A modern 100-ton mill was completed on this property at the end of 1921, but owing to the difficulty in finding a market for the output it was closed soon after it was finished. Last year, lessees who were operating the mine found some promising new ore, which attracted the attention of the Vancouver capitalists. The mill is to be reconditioned, and operations will be started, according to recent reports, at an early date.

The Consolidated Mining & Smelting Co. of Canada has purchased the Bluff Fraction, Jack Fraction, Mercury, Jill, Gopher, and Lassie claims, each from different owners, thus consolidating the group. The claims are situated on Kokana Creek, on the west arm of Kootenay Lake.

R. H. Stewart and associates have begun exploration on a group of claims on Campbell Creek, a tributary to Kaslo Lake. A. L. McPhee is supervising operations. Lessees at the I. X. L. mine, at Rossland, have shipped a carload of 48 tons of bonanza ore to the Trail smelter.

Utah-Apex Mining Co. Earned Quarterly Dividend in Month

Profits, before depreciation and depletion, of the Utah-Apex Mining Co. of Bingham, Utah, totaled \$185,212 for January. A dividend of \$132,000 was disbursed on Jan. 15. Earnings for the mine during one month were larger than dividend requirements for the first quarter by \$53,162.

Developments in the mine are favorable. On the 2,000 level, where a drift is being driven to open up a shoot developed on the 1,800 level, a strong lead of ore is being followed.

Diamond Drill Plays Part in Attempt To Rescue Floyd Collins

FLOYD COLLINS, cave explorer of Cave City, Ky., is dead. Had he lived, the story of his rescue would have included an account of an interesting mine operation including diamond drilling and shaft sinking. The accompanying photograph shows the top of the shaft through which access to the unfortunate youth's grave finally was obtained.

Subsequently further drilling was resorted to to check up on the formation.

The use of diamond drills in underground rescue is not new. In May, 1924, the rescue of five men in the Empire Zinc Co.'s mine at Gilman, Colo., was greatly facilitated by the drilling of a 2-in. diamond drill hole 90 ft. long. The work was done with a Sullivan



Photo copyright by Pacific and Atlantic Photos, Inc.

Sinking a shaft to reach Floyd Collins

H. T. Carmichael, general manager of the Kentucky Asphalt Co., was the first experienced miner to appear at Cave City. He immediately took charge of the work of shaft sinking and sent to his mine at Kyrock for one of the three Sullivan Bravo diamond drills that his company operates. This machine, run by a gasoline engine, bored a 1 $\frac{3}{8}$ -in. hole 60 ft. deep. At this point a large cavity was entered and drilling was suspended.

Beauty drill in six hours' elapsed time. Describing the rescue in seventy-eight hours, A. A. Buck, the mine superintendent, says that the drill hole first enabled him to communicate with the men, to learn that they were alive, and was then used to send them food, water, carbide, newspapers and playing cards. The men, when rescued, were none the worse for the experience, either physically or mentally.

New Financing for Union Minière Will Raise \$7,000,000

A special meeting of stockholders of the Union Minière du Haut-Katanga has been called for Feb. 23, to authorize the issuance of the following securities: 100,000 privilege shares; 4,000 capital shares; 4,000 dividend shares; and 200,000 bonds of 100 francs each. The bonds will bear interest at 4 $\frac{1}{2}$ per cent and will carry voting power.

Proceeds of stock financing are to pay for the construction of a large electrolytic copper refinery and the building of additional reverberatory furnaces. The company has outstanding and maturing soon bonds approximating 20,000,000 francs and the new issue will be used in part to refund this maturity.

It is understood that the Union Minière plans to bring its production

up to 400,000,000 lb. of copper annually. If the new shares are to be issued at 1,000 francs each, as rumored, the amount involved in the new financing will be about \$7,000,000.

Increase Production from New Mexican Manganese Mines

The Grant County Mining Co., operating on Boston Hill, just outside the corporate limits of Silver City, N. M., has increased its tonnage of manganese ore and is now shipping 1,000 tons a month to the Colorado Fuel & Iron Co. at Pueblo, Colo. Company officials hope to increase the shipments to 1,200 tons as soon as additional equipment can be obtained. At present mining is under way from fifteen open pits on the property; the U. S. Geological Survey estimates the deposits of manganese on Boston Hill at 500,000 tons.

Republic, Washington, Needs Capital

Low-grade Ore Marketable in Only Limited Quantity—Ore Dressing and Metallurgical Problems—Cheaper Power Needed

By O. W. Freeman

Special Correspondent

FOR MANY YEARS Republic has been the most important gold-mining camp in the State of Washington. It is situated in Ferry County, northwest of Spokane. The mines were first located in 1896, and about ten years later the city claimed a population of several thousand, and dozens of mines and prospects were being actively worked. Today 700 people live at Republic, and three mines are

\$9,500,000, of which about 83 per cent was gold and the rest silver.

The operating mines at Republic today are the Knob Hill, Surprise, and Quilp. The Knob Hill mine is opened by a vertical shaft until the vein is intersected, and then an incline follows the vein to what is called the 900 level, although the shaft and incline is not that deep. The Knob Hill vein dips about 45 deg. east, is several hundred

to the Trail smelter. The ore is a desirable siliceous flux, and smelter charges are therefore reasonable.

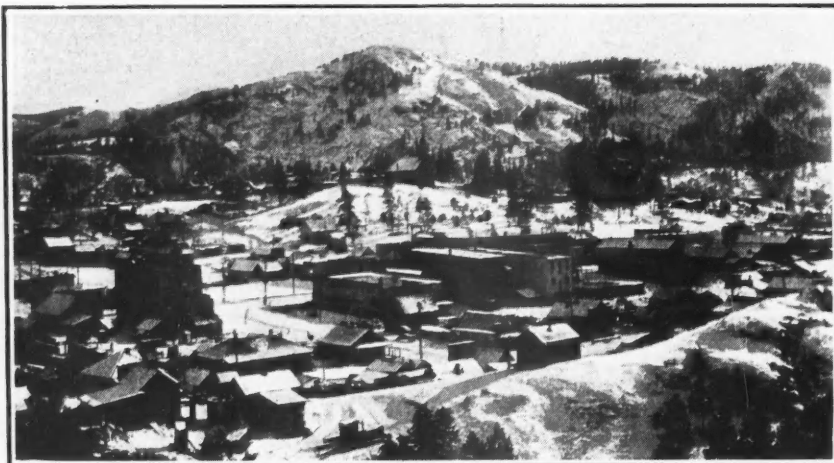
The Surprise and Quilp mines are adjoining properties, situated near the lower end of Eureka Gulch, and are operated through the same shaft. The Surprise shaft was 800 ft. deep, and is now being deepened by 250 ft. to a total of 1,050 ft. The Quilp is 950 ft. deep, and is worked by a winze in a drift from the Surprise shaft. The Quilp employs about fifteen men and is shipping ore regularly. The Surprise is doing considerable development work. Neither the Quilp nor Surprise can operate at capacity, as the smelters will contract for only part of their possible output. The ore in sight is of low grade and cannot stand a high smelter charge, and the amounts the smelters take is limited by their needs for a siliceous flux.

Will Develop Other Mines

The Golden Eagle adjoins the Quilp closer to the town of Republic and is being unwatered preparatory to a development campaign. The old Republic mine, south of town, was for many years the leading producer. It is now closed, but has been operated in recent years by lessees. It is said to contain considerable reserves of low-grade ore.

In Eureka Gulch several mines, such as the Lone Pine and San Poil, are said to have much milling ore in sight that is below smelting grade (about \$10 per ton).

Considerable tonnages of low-grade ore are known to exist at Republic, and there is no doubt that much more could be developed if there was a market for it. The great need at Republic is a mill that can treat \$5 ore at a profit. Several mills have been built in the past, among them the Republic and San Poil, but none have operated more than a short time. Their chief difficulties have been lack of power and the high expense of grinding. Wood at \$3 a cord proved too expensive a fuel. The present mines use Diesel engines, but it is contended that gas engines would be unsuited for a large mill. The small local electric plant has capacity for lighting only. A large mill would need to build a power line from the Columbia River for about thirty miles across the mountains from Kettle Falls, where a power plant is under construction.



The town of Republic, Wash., with Gibraltar Hill in the background

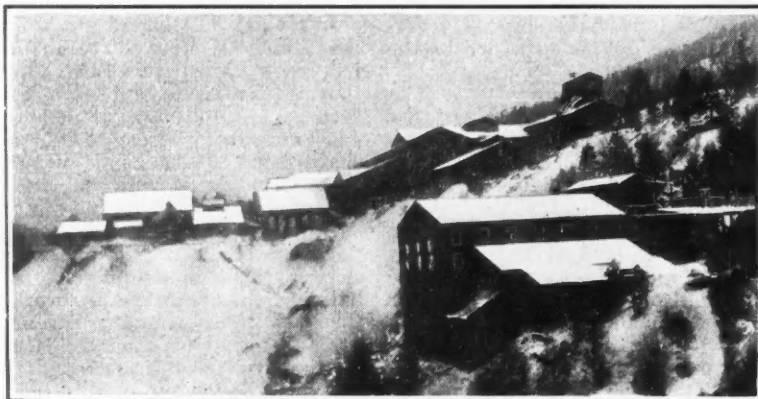
actively producing. Development work is being done on other properties, and a great amount of low-grade ore is known to exist.

Mineralization in the district is believed to be connected with the intrusion of the latite porphyry. The veins fill fissures that run approximately north and south and dip to the east 45 deg. and more. The vein filling is mainly siliceous and is usually well banded with dark material that seems to consist of tetrahedrite, pyrite, and chalcopyrite. Free gold is seldom seen, and the ores carry about four ounces of silver to one ounce of gold. The ore is unique in that it contains considerable selenium, and it seems possible that the gold may occur as a gold selenide. The veins vary from a fraction of an inch to several feet in thickness and are often slightly curved. They have been followed to a depth of 1,000 ft. without any apparent decrease in values. There is no zone of enrichment.

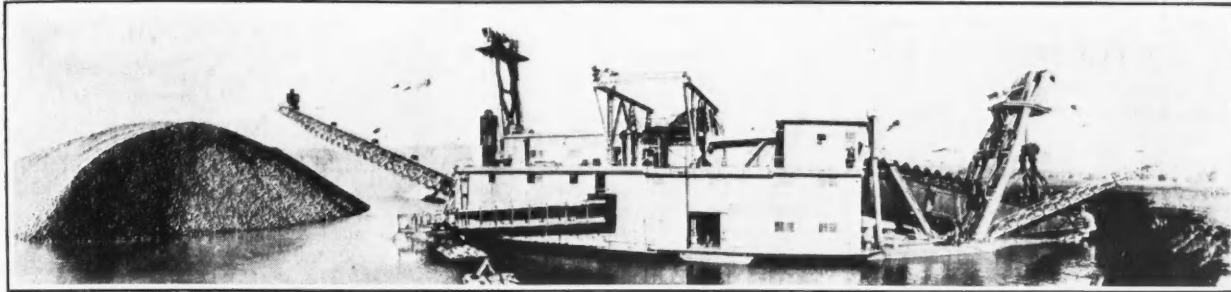
The mines make only a little water, and the wall rock stands well, so that only a moderate amount of timber is necessary. Railroad sidings run by each active mine. Gasoline and Diesel engines are used for power. No mill is now working in the district, and if ore is below smelting grade it has no market. Several mills were built in the past, but none was commercially profitable. The production of the Republic mines from their discovery in 1896 to the end of 1924 cannot be given accurately, but approximately equals

feet long, and varies from a few inches to over 6 ft. in thickness. The ore is often beautifully banded, and the values in gold and silver often run up to \$300 per ton. Without assays it is impossible to tell the value of the ore. Low-grade ore with values below that required to pay smelter charges is not mined. The vein is little faulted, and has shown no decrease in values to the present depth.

The wall rock is latite resembling andesite. The property is owned by California capital and was purchased three years ago for \$25,000. It is said to have cleared more than its purchase price the first year, which is true, also, of the two succeeding years. Now the mine employs twenty-five men and ships about 700 tons of ore monthly



Republic mine and old Republic mill



No. 5 dredge of the Marysville Dredging Co. just sold to the Yuba Consolidated Goldfields

A good recovery can be made from Republic ores when they are crushed to 160 mesh. In one of the mills a recovery of 95 per cent was secured, but fine grinding required too much power for profitable operation. Both ball and tube mills were tried, and the latter are said to have been the more economical. Desirable results might be secured from crushing the ore to about 40 mesh and concentrating by flotation to eliminate 60 per cent of waste and crushing the residue to 160 mesh and then cyaniding. Roasting the ore before cyaniding is said to have been beneficial in the early mills. Part of the trouble with the early mills was lack of proper financial resources. There seems to be an opportunity for a well-financed company to consolidate and make a large enterprise out of the present companies.

Stench Alarm Empties Iron Mine in Twenty-nine Minutes

An alarm system to inform miners to get out of the mine as quickly as possible was tried out recently at the Utica mine of Pickands, Mather & Co. at Hibbing, Minn., and was pronounced a decided success. Two pints of ethyl mercaptan was introduced into the discharge air line at the engine house by means of an air lubricator and the vapor penetrated the underground workings so rapidly that the 130 miners were notified by its striking pungent smell and were out of the mine in twenty-nine minutes. So strong is the stench that it works its way through leaks in the air line and causes the odor to be spread by the regular ventilating system. This mine covers eighty acres and the odor was carried a distance of a half mile to reach the men farthest from the shaft. The speed with which the odor is carried was demonstrated by the fact that miners after notification walked a half mile, climbed up 300 ft. of shaft and were in the dry house twenty-nine minutes after the liquid was introduced.

Yuba Manufacturing Co. to Build Alaska Dredge

The Yuba Manufacturing Co., of San Francisco, will construct a gold dredge for the Tanana Valley Gold Dredging Co., at Fairbanks, Alaska. The company's property is on Fish Creek. The dredge will be of the standard type with wooden hull and steel superstructure. The buckets will be 5 cu.ft. in capacity.

Hammon Interests Purchase Marysville Dredging Co.'s Property

The Marysville Dredging Co. has sold its property in Yuba County, Calif., to the Yuba Consolidated Goldfields. The sale was made in accordance with the vote passed at a recent meeting of the stockholders. It is stated that the purchase price is about \$250,000.

The Marysville Dredging Co. has been operating a fleet of dredges on the Yuba River since 1907. At different times five have been in operation. At present only one, No. 5, is operating. This is a steel dredge of the latest modern construction, using 16-cu.ft. buckets and dredging 350,000 yd. of gravel per month, to a depth of 85 ft.

The Yuba Consolidated Goldfields operates a fleet of several dredges on the Yuba River above the Marysville and will now add the purchased dredge to its own fleet.

It is understood that the sale is made in accordance with an understanding reached between Robert Livermore, president of the Marysville Dredging Co., and W. P. Hammon, managing director of the Yuba Consolidated Goldfields.

Plan Survey of Michigan Iron-ore Situation

An investigation of Michigan's resources in low-grade iron ore to determine the amounts contained in the state, its availability, and the best economic processes of preparation for markets is contemplated by the state's geology department in the near future, according to R. A. Smith, state geologist. The state's supply of ores of high grade, now produced in quantity second only to Minnesota, is rapidly being depleted, with the possibility of a dearth in the near future.

Though it is known that enormous supplies of low-grade ores are available in northern Michigan, the exact extent of these fields and their availability is not possible to estimate without a complete survey and thorough analysis of the fields. Little ore of low grade is now marketed, owing to the high cost of transportation and the unsatisfactory condition of some of the ores. The ores of the lowest grade now being sold are from the Cascade range, in Marquette County, and they run about 40 per cent in iron and are high in silica. The importance of the work to be done has long been recognized.

Will Reopen Humboldt Smelter If Copper Market Holds

Announcement has been made by G. M. Colvocoresses, general manager of the Southwest Metals Co., that the company's smelter at Humboldt, Ariz., will be restarted on April 1, provided the price of copper holds at 15c. In the meantime the shaft at the Bluebell property, in the Mayer district, will be deepened to the 1,500 level within the next few weeks. Bids for a contract on the continuance of the shaft, which will approximate 150 ft., have been asked for by the smelter company, and it is expected that the contract will be let soon.

Nevada Consolidated Copper Co. Will Make Own Grinding Balls

Anything in the way of scrap steel around the Nevada Consolidated plant at McGill, Nev., is to be melted hereafter and cast into new shapes in electric furnaces that have been installed recently.

The mass of steel debris left in the ruins of the concentrator, burned several years ago, will be made into balls for the grinding mills. The balls will be cast in Plessman molds, an invention of a former employee of the company.

Aside from utilizing the old scrap the excellence of the article turned out is a source of saving. The mechanical perfection of the balls and the quality of the steel is better than that of the usual steel balls. It is planned to produce from ten to fifteen tons of grinding balls per day, which will be more than adequate to supply the needs of the new plant.

The furnaces were installed by the Pittsburgh Electric Furnace Corporation.

Will Try Joseph Myers, Bingo Promoter, in Winnipeg

Joseph Myers, of Winnipeg, a director of the Bingo Mines, Ltd., in the Herb Lake district of Manitoba, was arrested at St. John, N. B., on his arrival from England on Feb. 16. He was accompanied from England by his lawyer, L. D. Moroswick, of Winnipeg. Myers was taken to Winnipeg for trial and was released on giving bail for \$100,000. He was arraigned in the police court on Feb. 19 on two charges of making false statements with intent to defraud, and was remanded until Feb. 27.

New C. & H. Furnace Will Handle 225 Tons Daily

Railroad Major Construction Work
Planned—Cliff Exploration Starts
in Spring—Recover After Fire

One of the three large furnaces which is being rebuilt at the Calumet & Hecla smelting plant, in the Michigan copper district, will have a capacity of 200 to 225 tons of metal a day. It will be used for melting purposes only, leaving two furnaces for refining. These furnaces, with the smaller units in operation, will afford ample facilities for the treatment of all copper of the Calumet & Hecla companies.

Aside from the 9-mile railroad from the Ahmeek mine to the Ahmeek stamp mill, no other construction work is under consideration by Calumet & Hecla. Work on railroad construction will be resumed early in the spring. The greater part of the grading and concrete construction were completed last fall, and completion of the project by July 1 is expected.

At Calumet & Hecla's Cliff exploration, in Keweenaw County, preparations are being made to build a surface plant consisting of boiler and engine house and compressor. Sinking will be started in the spring. Though the proposed crosscut from this shaft will cut the Calumet conglomerate and Osceola amygdaloid, interest centers largely in the examination of the old Cliff fissure vein, which will be reached. The fissure, which is four or five ft. wide, was very rich when this property was worked back in the 70's, Cliff being the first dividend payer in the Lake Superior district. There is hope, of course, that values will be found in the other veins to be explored in the Cliff lands, but the best prospect appears to be in the fissure formation.

Though work is progressing satisfactorily in No. 4 Calumet shaft, Calumet & Hecla, the repair crews have not yet been able to recover the body of Martin Coppo, pumpman, who was caught in the fire in this shaft on Sept. 16. Coppo was stationed in a pump room on the 56th level and was cut off by the flames. There was no chance for him from the start, as all means of escape were closed by fire, smoke, or gas.

New Company Will Build Cement Plant in California

The Yosemite Portland Cement Corporation, recently organized, has announced its intention to construct a 2,000-bbl. plant at Merced, Calif. A. Emory Wishon, of Fresno, is president of the corporation, which has \$1,500,000 available for construction and operation. The plant will be established northeast of Merced adjacent to the Santa Fe and Southern Pacific railroads.

The limestone deposits are in Mariposa County adjacent to the Yosemite Valley Ry. Preliminary work was done at the quarries by a group of promoters who were unable to finance their holdings and therefore disposed of their interests to Wishon and his associates. The clay deposit is near the plant.

Fine Scheme; but Why the "New Broom"?

A "New Broom" club is rapidly becoming popular in the Joplin-Miami district. It was founded by the Tri-State Zinc and Lead Ore Producers' Association and there is no membership fee or other assessment. Every ground boss in the district is eligible if his mine goes a month without a lost-time accident. When that is attested to, the ground boss gets a membership in the club, and the company is entitled to nail a new broom over its office door or on its derrick.

During the past month twenty mines went without a lost-time accident. The miners themselves are becoming interested and are themselves demanding goggles, steel helmets for tub-hookers, and other safety equipment. Heretofore it has been almost impossible to get them to use such devices, even though it was for their own protection.

Lewisohn Interests Acquire Campo Morado Mine, in Mexico

The Lewisohn interests, of New York, operating in Mexico under the name Reforma Mining & Milling Co., have secured control of the Campo Morado mine from the Ortiz heirs. The mine is popularly believed to be among the greatest gold-bearing properties in Mexico. It is situated in the Balsas River region in the State of Guerrero. Although discovered more than 300 years ago, it has not been worked to capacity by modern methods, because of disturbed conditions and conflicts among the heirs. Development is planned.

German Metals Cartel in Good Position, Report Shows

For the first time in seven years the leading companies comprising the German Non-Ferrous Metals Cartel have issued public statements showing the status of their business. These reports cover the fiscal year ended Sept. 30. The reports show that the concerns have received large foreign loans, particularly from the United States. A significant feature of the reports is that the number of employees during the business year was greater than in the pre-war year of 1914.

The reports also show that during the years that the German producers were shut off from world markets an intensive program of scientific research was carried on. Special studies were initiated looking to the improvement of working methods. Because of the efficiencies which have resulted from this program the business of the companies is showing a satisfactory improvement, despite the fact that coal prices and freight rates still are high.

The foregoing is based on reports received from the representatives of the United States Department of Commerce in Germany.

Washington News

By Paul Wooton
Special Correspondent

Chile Copper Recovers \$269,710 Protested Federal Tax

The decision of the lower court denying the government's suit for \$269,710 in taxes and interest alleged to be due from the Chile Copper Co. for the years 1916-17-18 has been affirmed by the United States Circuit Court of Appeals.

William H. Edwards, Collector of Internal Revenue, brought the suit in 1923, claiming that amount was due the government on the company's operations in connection with the Chile Exploration Co. The copper company fought the suit on the ground that it was not doing business under the Revenue Act, as it was only formed to help the financing of \$35,000,000 worth of the exploration company's bonds.

Though the exploration company is incorporated in New Jersey, it was contended, the Chilean law made the flotation of bonds in this country difficult. The Chile Copper Co. was formed, it was claimed, to overcome this difficulty.

Judge Hand agreed with the defendants, and ordered the return of the tax money, paid under protest.

No Committee Recommendation on Gold-Silver Commission

The United States Senate Committee on Audit and Control is not willing to pass upon the desirability of continuing the Commission of Gold and Silver Inquiry. It is willing, however, to report without recommendation the bill continuing the commission during the next Congress. This will make it necessary for the Senate to give consideration to the legislation. In this way the measure will be brought before the Senate for specific action, otherwise failure to act would allow the commission to expire with the Congress on March 4.

Senator Oddie, the chairman of the commission, insists that the matter be discussed on the floor of the Senate and a vote taken, so that there may be a record of those who oppose the work being done on behalf of the gold and silver producers and the reasons ascribed for their position.

Copper Tariff Advocates Keeping Quiet for Present

Though the reason advanced for the failure to agitate the proposed copper tariff is that it would be useless because of the shortness of the session, it is believed that it is the improved price for the metal which has taken the wind out of the sails of those proposing it. It is true that the Administration leaders decreed that tariff changes would not be considered at this session, but that would have been no bar to an effort which would have brought about discussion and publicity, two objectives which were admittedly essential preliminaries so that the public could learn of the great benefits which the duty is expected to bring.

London Letter

By W. A. Doman
Special Correspondent

Decline in City Deep Shares Accompanies Many Rumors

"Leak" Indicated in News of Burma
Mines Fire—Shares Tumble in
Apparent Anticipation

London, Feb. 10—Once more City Deep shares (Rand) are under a cloud. Within the last few days they have fallen about 10s., and no official information is forthcoming. A couple of prominent London operators are at present in Johannesburg, and it is suggested that they have sent selling orders. One firm on the London Stock Exchange is known to have received a cable dispatch from its local correspondent to the effect that he does not like the position at the City Deep. Without any further explanation this message gives rise to all sorts of surmises, and the shares have been sold heavily. Discussion of the position among mining men and on the Stock Exchange has resulted in the following rumors: There are fears of earth tremors, and the loss of some rich ore reserves in the upper levels where the strain from the Meyer & Charlton at the outcrop is beginning to tell. This fear, apparently, has been experienced for a considerable time and is nothing new. There is talk of poor developments, though the officially published figures do not indicate these. Then, there is also talk of a "bear" raid in anticipation of poor reef being struck in the No. 4, a subvertical shaft, which is due to reach the south reef at any moment. This shaft is already down about 6,000 ft. vertical. Inquiries at the London office have elicited no information, and certainly nothing is known of poor developments. The ore reserves, at the present rate of crushing, are sufficient to supply the mill for about two years, though I understand that an increase will be shown when the annual report for 1924 is presented.

The City Deep has been subjected to adverse rumors for years, but they do not seem to have affected the dividend-earning powers. The latter reports have nevertheless upset investors. Robinson Deep shares have been sold for similar reasons, but no news has come to hand to warrant pessimism.

Another outbreak of fire is announced at the Burma Corporation mine, and as this was accompanied, or preceded, by heavy selling, it almost looks like a leakage of information. It is strange, but nevertheless true, that certain brokers receive cable dispatches from various mines before the companies publish anything.

Having turned down the Union Corporation offer to work the Geduld East lease (Rand), the government is again advertising for tenders, and it is half suggested in some quarters that the Lewis & Marks group may submit an offer. They have not met with such success with the East Rand Mining Estates, or Grootvlei, but a combination of the lot may prove more fortunate.

Johannesburg Letter

By John Watson
Special Correspondent

Transvaal Gold Output £43,038,905 for Year 1924

Easily a Record—Lydenburg Platinum
Fields Seem To Be of Increasing
Importance

Johannesburg, Jan. 13—The following crushing results for December from the leading profit-earners of the Rand have recently been published:

	Tons Crushed	Value or per ton			Costs Milled	Esti- mated Profit £
		£	s.	d.		
Government Areas.....	157,000	319,422	17-	9.6	182,333	
New Modder.....	125,000	274,479	16-	8.4	170,079	
Crown Mines.....	225,000	300,567	18-	3.8	94,510	
Van Ryn Deep.....	66,800	126,240	18-	1.0	67,589	
Modder Deep.....	43,800	99,927	15-	11.0	65,094	
Springs.....	66,700	129,997	20-	10.9	60,252	
City Deep.....	99,000	163,899	22-	2.3	54,048	
Brakpan.....	80,100	130,236	19-	4.2	52,740	
Geduld.....	74,500	114,040	18-	3.0	46,036	
Modder B.....	64,500	107,082	19-	1.0	45,526	
Robinson Deep.....	70,500	107,082	16-	10.9	45,152	
New State Areas (a) Randfontein Estates.....	171,000	203,513	21-	2.7	25,182	

(a) Comparatively poor results, due to shaft accident and stoppages.

The Transvaal gold output for December was declared on Jan. 10 as 825,273 oz. having a realizable value of £3,631,201. These figures show an increase over the previous month of 22,960 oz. or a value equal to £60,908. The Transvaal gold output for 1924 totals 9,597,634 oz. having a realized value of £43,038,905. These figures easily establish a record both for value and quantity. They exceed previous year's results by £3,280,222 and 464,574 fine oz. The labor returns show 441 fewer natives working on the gold mines compared with the end of November.

Dr. Hans Merensky, a well-known geologist, has recently reported for the Lydenburg Platinum, Ltd. After examining small alluvial deposits along the spruits, it was proved that the extensive alluvial flats on the Steelpoort River at Burghersfort also carried platinum. In the first half of September it was discovered that a gray-green band of norite carried in its upper portion both gold and platinum. The first assays showed 2 to 4 dwt. platinoids per ton. This orebody was followed through several farms North of Maandagshoel. Early in October, the same orebody was established to the south of the Steelpoort River. In this Lydenburg district, discoveries of platinum have now been made, in alluvial, under similar conditions to those obtaining in the Ural Mountains. The main orebody occurs as a sheet of gray-green norite. Values have been found up to 7.5 dwt. in the hanging wall over widths of from 3 to 8 ft. Apart from their importance to the Eastern Transvaal, the platinum occurrences will prove of great moment in the economic life of the whole country and the discovery may ultimately prove to be the most important since the opening of the Rand.

Toronto Letter

By Our Special Correspondent for
Northern Ontario

Wright-Hargreaves Report Shows Big Increase in Output

Lake Shore Dividend—Quebec Expected
to Levy 3 per Cent Tax on Profits
of Gold and Silver Mines

Toronto, Feb. 21—The annual report of the Wright-Hargreaves Mines, Ltd., Kirkland Lake, for the year ended Dec. 31, 1924, shows that during the year the mill treated 84,487 tons of ore and recovered \$1,088,725, an increase of \$330,000 compared with the previous year. The ore averaged \$12.89, compared with \$9.52 in 1923. The total costs, including depreciation, were \$535,049, leaving net profits, including other income, of \$580,514, an increase of \$275,000. Operating costs were \$5.522 per ton, to which was added depreciation of \$0.811, giving a total cost of \$6.333. Dividends paid amounted to \$206,250, an increase of \$69,250. Broken ore in the mine is shown at 118,331 tons, an increase of 41,600 tons. The financial statement shows excess of current assets over liabilities of \$634,937. The mill treated an average of 230 tons a day, compared with 217 tons in the previous year. The increase, however, all came in the last few months of the year, when the mill was enlarged, and at the present time 400 tons a day is being treated. The most significant development during the period was the discovery of the No. 1 vein on the 1,000 level, which has now been drifted on for 940 ft., with good ore showing in the face. It is understood that this ore will run about \$20 over a width of approximately 4 ft.

Directors of the Lake Shore mine, adjoining the Wright-Hargreaves, have declared the regular dividend of 5 per cent, payable March 16, to shareholders of record March 2.

On the Provincial property in Cobalt, which is now under the control of the Clifton Consolidated Mines, a new vein has been found on the 300 level. The vein is about 3 ft. wide, consisting of a number of small stringers, although in one place it is reported that there was about 12 in. of smaltite, carrying good values in silver.

During January, the Nipissing Mining Co., of Cobalt, mined ore of an estimated value of \$132,906 and shipped bullion of an estimated net value of \$262,836.

It is understood that at the present session of the Quebec Legislature a new tax act will be introduced, similar to the one in force in Ontario. At present the Quebec tax act does not specify any definite rate of taxation for gold and silver mines; asbestos mines pay a royalty of 5 per cent of the gross value of their output. The new act, however, will provide that taxes shall be assessed on profits only, and it is expected that the rate will be the same as in Ontario, namely, 3 per cent. In Manitoba, where there is now more mining activity, it is believed that efforts will also be made to have an act similar to that in Ontario introduced.

Men You Should Know About

H. L. Donaldson has been appointed manager of the Kirk Gold property, in Kirkland Lake.

D. H. Fairchild, of Chicago, has just completed a professional trip through Alabama, Missouri, and Illinois.

S. Shannon, president of the Rescue Eula mine, is in Tonopah making an examination of the conditions at the mine.

Roy D. Wood, of Salt Lake City, metallurgist and assistant treasurer of the Research Corporation, is now in New York.

O. C. Davidson, of Iron Mountain, Mich., general superintendent of the Oliver Iron Mining Co., has gone to his home in Miami, Fla.

J. L. Teale has resigned from the firm of Bainbridge, Seymour & Co., of London, and **Colonel H. H. Yuill** has become the sole proprietor of the firm.

D. E. Sutherland, of Ironwood, Mich., assistant general superintendent of the Oliver Iron Mining Co., is on a vacation at Palm Beach, Fla.

H. R. Plommer has been appointed treasurer for the Granby Consolidated Mining, Smelting & Power Co., to succeed **Valentine Quinn**, resigned.

Fred Searls, Jr., who recently returned to Phoenix, Ariz., from Mexico, visited the Magma Copper Co. en route to his headquarters in San Francisco.

J. C. Houston, mining engineer, has been placed in charge of operations at the Penn-Canadian silver mine of Cobalt, Ont., where work has recently been resumed.

A. K. Merrill, chief accountant of the United States Steel Corporation, will, it is announced, be chosen president of the newly reorganized Boston Montana Mining Corporation.

Dr. W. S. Dyer, of the University of Toronto, has accepted a position on the staff of the Canadian Geological Survey, and will during the coming season be engaged in stratigraphical work in Alberta.

George W. Nilsson, for the last nine years assistant general counsel for the United Verde Copper Co., is now associated with Page, Nolan, Rohe & Hirt, 1010 Hellman Bank Building, Los Angeles, Calif.

Webb Smith is now superintendent of the Kennedy mine, at Jackson, Calif. Mr. Smith was superintendent of that mine for a number of years and then retired, but late in 1924 he resumed his old duties at the Kennedy.

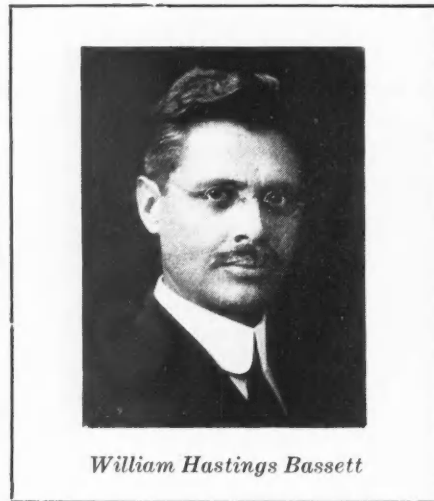
Chester H. Westfall, who has been associated with the Marland Oil Co. of Mexico for a number of years, has been appointed president. This company will move its headquarters from Mexico City to Houston, Tex.

E. W. Todd has resigned his position on the geological staff of the University of Toronto to accept a permanent engagement with the Ontario Department of Mines, for which he has been en-

gaged in field work in the province for several seasons.

David Cole, consulting engineer of El Paso, Tex., recently returned to that city from a professional visit to Anaconda, Mont., and has left for Chihuahua, Mexico, to inspect the construction work on the El Potosi mill.

Albert Silva, formerly chief metallurgist for the Tonopah Belmont Development Co., has returned to Tonopah after several months spent at Chicagoff Island, Alaska, where he has had charge of construction of a cyanide plant.



William Hastings Bassett

William Hastings Bassett was on Feb. 18 awarded the James Douglas Medal "for constructive research in copper and brass and other non-ferrous metals and their alloys and for his contributions to the establishment of the present high standards of quality." Presentation of the medal took place at the annual banquet which marks the winter meeting of the A. I. M. E. in New York, held at the Waldorf.

In the article on the Katanga copper operations by Owen Letcher in our issue of Feb. 14, **Archer E. Wheeler**, the American metallurgist who has been consulting engineer to the Union Minière for several years, was referred to in error as **A. S. Wheeler**.

M. M. Duncan, vice-president and general manager for the Cleveland-Cliffs Iron Co., with offices at Ishpeming, Mich., has been seriously ill for the past several weeks. His duties are being performed by **S. R. Elliott**, assistant general manager of mines.

James J. Godfrey, president of the Kay Copper Co., operating near Canon, 50 miles north of Phoenix, Ariz., accompanied by fourteen associates, recently visited the property of the company. In Mr. Godfrey's party was **Oscar Haglund**, discoverer of the Mother Lode, in Alaska.

John M. Bush, mine superintendent in the North Lake district, Michigan, for the Cleveland-Cliffs Iron Co., has been appointed land agent for the same company, with headquarters at Negaunee, Mich. He will look after the 600,-

000 acres of timber and mineral lands which the company owns in northern Michigan.

John G. Kirchen, general manager of the Tonopah Extension Mining Co., was re-elected president of the Nevada Mine Operators' Association at a recent meeting. **A. H. Lawry** was elected first vice-president; **C. A. Heller**, second vice-president, and **H. M. Rives** was re-elected secretary-treasurer.

Henry Wyman and **J. H. Sanford**, president and vice-president of the Pittsburgh Vetagrande Mining Co., are making one of their periodical trips in Mexico and will spend a few days in Mexico City, Tampico, Cananea, and Zacatecas examining the various mining properties controlled by their company.

D. A. Mutch, who was recently in charge of the Night Hawk Peninsular mine, in the Porcupine area of northern Ontario, and previously for six years manager of the Coniagas reduction plant at Thorold, Ont., has been appointed assistant general manager of the African Manganese Co., and is now on his way to West Africa via London.

Major Tador Trevor, Inspector of Mines for the Pretoria district of South Africa, will soon retire from the Union Government service. He is now returning to South Africa from England, where he held official position in the South African Mineral Section of the Wembley exhibition. It is understood that Major Trevor will receive an important appointment in Rhodesia, under the Colonial office.

Simon Guggenheim, president of the American Smelting & Refining Co., and former United States Senator from Colorado, and Mrs. Guggenheim announced on Feb. 23 a preliminary gift of \$3,000,000 for the endowment of the John Simon Guggenheim Memorial Foundation Fellowships for advanced study abroad. The purposes of the foundation are: "To improve the quality of education and the practice of the arts and professions in the United States, to foster research and to provide for the cause of better international understanding."

P. S. Williams has resigned as superintendent of the Castile Mining Co. at Ramsay, Mich. He has been succeeded by **J. M. Price**, superintendent of the Montreal Mining Co. at Montreal, Wis. **R. A. Bowen**, who was superintendent of the Bristol Mining Co., at Crystal Falls, Mich., succeeds Mr. Price. **F. J. Smith**, superintendent of the Berkshire mine on the Menominee Iron Range, has been made superintendent of the Brule Mining Co. and the Bristol Mining Co., at Iron River and Crystal Falls, respectively. **Barney Knudsen**, formerly assistant superintendent of the Berkshire mine, has been advanced to the position of superintendent. All the above-named companies are subsidiaries of Oglebay, Norton & Co.

Obituary

Harry Collbran, pioneer mining man and railroad operator of Colorado, died on Feb. 15 in London.

Societies, Addresses, and Reports

Why the Court of Appeals Upheld the Carson Patents

Evidence Indicates Winner of Suit Against the A. S. & R. Had
Original Idea of Charging Everything Along Sidewalls
—Charles' Patent Applied Only to Fettingling

THE following excerpts from the opinion of the United States Circuit Court of Appeals, in the Carson patent suit for the side feeding of reverberatory copper-smelting furnaces, will interest many metallurgists. The appellant, George Campbell Carson, was represented by John H. Miller, Charles S. Wheeler, and A. W. Boyken, and the appellee, the American Smelting & Refining Co., by F. P. Fish, A. M. Austin, and J. A. Shackelford. The appellant brought suit for the infringement of the claims of two patents, No. 1,149,495, issued Aug. 10, 1915, and No. 1,302,307, issued April 29, 1919. The suit had been dismissed on the ground that the claims were anticipated by the British patent to Siemens, No. 2,413, issued in 1866.

"The claim of the first patent is as follows:

"In a metallurgical furnace having receptacles arranged above the roof thereof, passages from said receptacles leading to said furnace arranged in such a manner that the material in said receptacles passes out into said furnace by gravity and form the lining thereof."

"In the second patent the claims here involved are as follows:

"2. The method of protecting the walls of an open hearth or reverberatory furnace which consists in feeding the ores or fettling materials into the furnace chamber near the upper part thereof, and in causing the same to form a sloping embankment resting upon the floor of the furnace chamber and along the walls within the chamber between the bath and wall.

"3. In an open hearth or reverberatory furnace, a floor, walls extending upwardly from the floor, and feeding ports leading into the upper part of the furnace chamber and being so located that the ores or fettling materials entering therethrough may have unrestricted vertical movement downwardly to the said floor near the walls and may form sloping embankments against the walls to protect the latter from the heat and corrosive action of the metal bath."

"Subsequently the appellant filed a disclaimer eliminating from the claims the words 'or fettling materials.'

"Upon a careful consideration of the evidence we are of the opinion that the Board of Examiners at the Patent Office correctly held that the appellant's invention is not anticipated by the Siemens patent. The Siemens patent, granted in 1866, was for a blast furnace, designed for the proposed purpose of producing steel directly from iron ore, although Siemens added that it might be 'used with advantage for the reduction of copper and other metallic ores.' Siemens declared his invention to consist in exposing a mass of ore, 'which may or may not be mixed with reducing agents or fluxes, to the surface action of intense heat produced by the combustion of highly-heated air and gaseous fuel.' The anticipatory

feature of the Siemens furnace is claimed to be the sloping sidewalls of the reducing chamber into which ore was to be supplied by gravity so as to maintain the mass of ore upon the sides of the chamber in proportion as it is converted and fused, 'so as to protect the walls or inclined surfaces thereof from the heat of the furnace and the corrosive action of the slags or cinders of the metallic bath by the interposition of the ore itself.'

"The Siemens patent was a failure and it never went into use and while it may be conceded that Siemens was the first to conceive the idea of utilizing the ores to protect the sidewalls of a furnace, the fact remains that if his invention was ever at any time adopted in a reverberatory furnace, it must have resulted in failure, for we find for forty years thereafter, and up to the time of the appellant's invention, that there was universal use in reverberatory furnaces of perpendicular sidewalls, the banking of materials against them for protection thereof and the supply of ores through openings along or near the center line of the roof and never at the sides. A foreign patent is to be measured as anticipatory not by what might have been made out of it, but by what is clearly and definitely expressed in it. An American patent is not anticipated by a prior foreign patent unless the latter exhibits the invention in such full, clear, and exact terms as to enable any person skilled in the art to practice it without the necessity of making experiments.

"The court below was of the opinion that the practicability of the Siemens patent was established by the experiments made in the appellee's furnace at Garfield, Utah, after the commencement of litigation over the appellant's patent. The experiments were conducted by the appellee's employees. The chief operator testified that there were strict orders against the presence of visitors and that neither the appellant nor anyone in his behalf was invited to be present. Evidence of experiments thus conducted by an interested party and in the absence of his adversary is always received with suspicion and is more or less discredited.

"The testimony of the appellee's witnesses was in substance that ordinary reverberatory furnaces were converted into Siemens furnaces by constructing at the smelting ends thereof and for a distance of about one-half their length, supplemental sloping brick walls at an inclination of 60 deg. in front of the vertical sidewalls, leaving the remainder of the furnaces with vertical sidewalls. . . .

" . . . It would seem that the ex-

periments have little value in determining the practicability of a furnace made with inclined sides throughout as indicated in the Siemens patent and that in the experiments as conducted the suggestions of the Siemens patent were expanded to meet the requirements of successful operation in the light of subsequently acquired knowledge and experience.

"Aside from the defense of anticipation the appellee brings forward the contention that claims 2 and 3 of the divisional patent are void for want of invention in that they were perfectly obvious to anyone skilled in the art. This attitude of the appellee is directly the contrary of that which it assumed on its application in the patent office for reissue of the Charles patent No. 871,477 of Nov. 19, 1907, of which it was the assignee. Therein it copied literally claims 2 and 3 of the appellant's divisional patent and demanded an interference, asserting that Charles was the original and first inventor. In so doing the appellee vouched for the patentability of the features disclosed in the claims and also asserted their validity as against anticipation by the Siemens patent. We are of the opinion that the claims are not lacking in invention. The strongest circumstance in favor of their patentability is the fact that for nearly half a century ores had been fed into reverberatory furnaces through openings of the roof at or near the center line thereof and it had occurred to no one to feed them through side openings. The appellant, according to the testimony, conceived in the year 1902 the idea of delivering the ores against the inner walls of the furnace. It was not until the year 1915 that his method was put into use, and thereafter its use was practically universal. Clearly its advantages had not been obvious to those who were skilled in the art.

CARSON'S IDEA NOT LIMITED TO FETTLING

"It is contended that the appellant's original application for patent involved no invention other than a method of delivering fettling materials to protect the walls of a furnace through hoppers or passages at the sides of the roof instead of shoveling it through openings in the sides of the furnace as was theretofore done. To this, the court brought out evidence that in his original drawings Carson had made no provision for feeding ores otherwise than through the holes in the arch along the sidewalls, and that that evidently was his intention.

"The appellee contends that Henry Lewis Charles invented side feeding and reduced his invention to practice at Butte, Montana, and at Bingham, Utah, before the earliest date of the appellant's invention, and that the Charles application for patent, filed on March 26, 1907, discloses the appellant's idea of feeding ores through passages near the sides of the roof to form a lining or embankment against the walls of the furnace. The Charles patent discloses as its principal feature a method of feeding ores in a continuous or intermittent stream through numerous small openings in

the roof of the furnace, and in addition thereto the use of small hoppers near the sides of the furnace for the purpose of supplying silica or siliceous material for fettling. Neither in the drawings nor the specifications is there a suggestion of the appellant's idea of feeding all the ores to be smelted through openings at the sides of the roof so as to form a border resting on the hearth and against the walls of the furnace and dispense with fettling.

NO PUBLISHED RECORD OF CHARLES' EARLY WORK

"Nor does the evidence convince us that Charles put the appellant's invention into open and public use in 1905 or 1906. The evidence of such prior use consists wholly of the oral testimony of witnesses given eighteen years after the event. It is unaccompanied by writing, drawing, model, or kindred exhibit, or physical evidence of any kind. Charles testified that in the roof of a furnace at Butte he first cut two holes over the angles made by the bridge wall and the sides of the furnace, that through those holes he introduced ores which at first did not act to his satisfaction, but that finally he poured a highly siliceous ore carrying over 90 per cent silica which was found satisfactory. If he did this he must have done it solely for the purpose of fettling the corners as was later indicated in his patent and he had no idea of supplying the furnace with smelting ore through such holes. He testified that his experiment was made, as nearly as he could recollect, about December, 1905. On Jan. 2, 1920, he made an affidavit in reply to a demand of the Patent Office that he designate the date when he made his invention. In that affidavit he stated that he was the superintendent in charge of the furnace at Butte, from March, 1906, until the summer of that year, that 'during this period side fettling through openings in the roof was continuously used to the best of my belief.' He stated that thereafter he went to Bingham, Utah, where he took steps to install mechanical feeding through the roof and along the sides of the furnace 'as shown in my patent. It is my belief that side feeding through holes cut in the roof was used at Bingham.'

"The testimony of the other witnesses is all to the effect that silica and siliceous ores were poured through the side hoppers to protect the walls. There was testimony tending to contradict all the evidence of the experimental use at Butte and at Bingham. The general manager of the furnace at Butte, under whom Charles was employed as superintendent but who left about the first of July, 1905, testified that while he was there no side hoppers were placed along the sides of the furnace and there was no side charging of ores. He thus contradicted the testimony of Charles that the side charges were in operation in May, 1905. Another witness, employed at the Butte furnace as chief assayer and a portion of the time as acting superintendent, testified that the old style of center charging and hand fettling was the only method practiced up to the time when he left, which was Aug. 1, 1906.

There was other testimony of workmen at Butte who testified that the only method of charging was through the center hoppers and that all the fettling was done through the side doors by hand. The testimony as to the practice at Bingham during the years 1906 and 1907 is very similar in character to that concerning the furnace at Butte. Of significance in this connection is a letter which Charles wrote to the *Engineering and Mining Journal* on Sept. 6, 1915. In that letter he said he had proved 'in a small experimental way in Montana that if a satisfactory base were secured, the material could be dropped along the sidewalls or bridge and made to stick just as it does on the bottom of the furnace when charged in the old way too rapidly.' But later he added 'Before my plans were worked out Mr. Heinze sold his Montana interests to the Amalgamated.'

"In *Deering v. Winona Harvester Works*, 155 U. S. 286,300, it was said: 'Oral testimony unsupported by patents or exhibits tending to show prior use of a device regularly patented is in the nature of the case gravely open to suspicion,' and the court affirmed the wisdom of the rule requiring such anticipation to be proven by evidence so cogent as to leave no reasonable doubt in the mind of the court that the transaction occurred substantially as stated. The court below found as follows: 'Side feeding or charging was not practiced by Charles prior to the alleged invention by Carson. The most that was done was limited fettling back of the bridge, and around the corner, and the only attempt was to protect the angle between the bridge wall and the side-wall.'

MAINTAINING PERMANENT BANK OF ORE DOES NOT ESCAPE INFRINGEMENT

"In support of the defense of non-infringement it is said that the creation and maintenance of a permanent immovable bank of raw, semi-fused, baked-in ore in the appellee's furnace does not embody the subject matter of the appellant's claims, that the permanent embankment is not composed of material in the process of smelting, but remains in place, absolutely intact for months of operation. There can be no question but that the appellee infringes the claim of the appellant's first patent. It is true that in the appellee's structure the hoppers are elevated a short distance above the roof, whereas in the appellant's drawing the hoppers are contiguous to the roof. But the appellant's patent calls merely for placing the hoppers 'above the roof,' and the appellee has not in substance departed therefrom. As to the divisional patent the evidence is that the appellee has operated its furnace at Tacoma in a different manner when treating ores alone from the manner when treating ores mixed with flotation concentrates. When treating ores alone the ore was crushed to the necessary degree of fineness, mixed with fluxes, and so fed into the furnace as to build up sloping embankments. That method is covered by Claim 2 of the appellant's second patent. And when operating with ores mixed with flotation concentrates, that is to say,

ores which have been reduced to the highest degree of fineness, the appellee first builds up sloping embankments of raw ore which are allowed to smelt until their surface becomes semi-fused. Thereafter flotation concentrates mixed with other ores and fluxes are fed through the side holes of the roof and allowed to flow down and over the sloping ore embankments. In the smelting process when the ore banks become depleted resort is had to rebuilding, and fresh ore without flotation concentrates is fed for that purpose. It is obvious that by using calcined flotation concentrates mixed with ores and fluxes instead of ores alone there can be no avoidance of infringement. The evidence does not sustain the alleged difference predicated on the assertion that the appellee's sloping embankments are permanent and the appellant's are continually changing. The fact that a portion of the appellee's embankments immediately adjacent to the sidewalls is permanent results from the fact that the heat does not penetrate the whole distance, and the fact that as the embankment is reduced by smelting it is rebuilt with fresh batches of ore. Carson contemplated this when in his first patent he said: 'Ideal smelting charges can be fed and the portion next to the furnace walls never reach the point of fusion, while that portion in the interior of the furnace will be in a high state of fusion.'

Mining Congress Chapter at Grass Valley

The American Mining Congress established a new chapter in Grass Valley, Calif., on Feb. 11. F. W. Nobs, general manager of the Empire Mines, was selected as governor of the chapter; Robert Bedford, Morris Roche, and W. H. Martin were named vice-presidents, and H. L. Englebright was selected to be secretary and treasurer. A. B. Foote, general manager of the North Star Mines, was chairman of the meeting. The chapter started with sixty-five members residing in Nevada County and adjoining counties.

Idaho Mining Men Meet

The eleventh annual convention of the Idaho Mining Association convened in Boise on Feb. 13, with about sixty delegates present. In the absence of C. W. Newton, the president, James F. McCarthy, of Wallace, acted as chairman. Addresses were made by Governor C. C. Moore, of Idaho, Mayor E. B. Sherman of Boise, and A. W. Fahrenwald, of the Bureau of Mines at Moscow.

Among the speakers was Jerome J. Day, director for Idaho of the Silver Producers' Association, who explained the objects and organization of the association. Scathing denunciation of House Bill No. 162 was made by W. C. Clark, chief electrician of the Bunker Hill & Sullivan Mining & Concentrating Co. This bill has features taxing water-power developed within the state. The speaker claimed that it would greatly hamper mining and irrigation.

James F. McCarthy, of Wallace, was elected president; J. B. Eldridge, of Boise, vice-president, and Ravenel Macbeth, secretary.

Recent Technical Publications

Reviews, Abstracts, and References

Marketing Conditions in Foreign Countries

Our Competitors and Markets. By Arnold W. Lahee. Henry Holt & Co., New York. Price, \$5.

The title of this book, "Our Competitors and Markets; an Introduction to Foreign Trade," may possibly create in some minds the impression that here is simply "another book on foreign trade." To classify it thus and, possibly, because of this to dismiss it from further consideration would hardly be just to the author, who, incidentally, was formerly head of the department of foreign trade extension of the Mechanics and Metals National Bank of New York. Mr. Lahee's purpose in writing the book has been to make his readers acquainted with the principal foreign countries with which the United States has commercial relations, his description in each case being based upon the fundamental economic trend in the country described. The most significant facts of commercial geography have been woven in, so that the book is of considerable value in this respect as a work of reference. Thus the author hopes to make it possible for his readers to interpret events abroad with regard to their importance to American trade and investment interest.

In the fifteen chapters of the book, he discusses, first, the interests of the United States, then Great Britain, Germany, France, Argentina, Brazil, and Chile. The West Indies and Central America are considered separately as units, then Mexico, China, Japan, Malaysia, India and Australia.

Mr. Lahee does not turn from any one of his subjects without expressing a definite opinion—in no case does he "sit on the fence." As to Europe, he concludes, the primary interest of the United States will be concerned with her strength as a competitor rather than as a market for our manufactures or as a source for industrial materials. Other countries, in contradistinction to Europe, are of interest to us as sources of foodstuffs that we do not grow ourselves and of materials for our industries, and as markets for the sale of our manufactures. "Proximity makes North America our best market. Trade with Canada is practically an extension of domestic trade." As to what Europe owes the United States: "There is no particular need to press for hasty liquidation. Europe's moral integrity has been proved by past history."

The United Kingdom is interesting to the United States, he thinks, simply in relation to her strength as a competitor. The prospect of Germany's resurrection as a competitor of ours is remote. France, he thinks, is on the threshold of an industrial awakening but will be occupied for some decades to come with her internal and colonial markets. Argentina will be a highly competitive field. Brazil is a country upon the threshold of a vast development. "Can we shut our eyes to this

rich field of opportunity lying so close at hand?" he inquires. He is not enthusiastic about Chile. There, he thinks, our chief interest is in the opportunity for investment, but for the big investor rather than the small. As to the possibility of a stable government in Mexico he is dubious.

The only possible cure for China's ills is the rigid enforcement of audit control, which, he thinks, must be imposed from without. "The question is, by whom?" As for Japan, it must obtain a source of raw materials or be eclipsed ultimately by China. Interference by the United States will bring war with Japan, waged at our disadvantage. The alternative, to desert China, Mr. Lahee says, is a reversal of our policy and leads to the "Yellow Peril." Advantages of trade with Australia and New Zealand are offset by certain disadvantages.

Mr. Lahee has an interesting subject and has treated it capably. Some of his conclusions are open to debate, but this will not detract from the value of the book to those who are studying business opportunities abroad.

A. H. HUBBELL.

Patents

Cylindrical Grinding Mills

No. 1,521,217. Dec. 30, 1924. J. S. Fasting, Valby, Denmark, assignor to F. L. Smidth & Co., New York City. A cylindrical ball mill with an overhanging supplementary drum at each end, beyond the trunnions, thus making a three-compartment mill.

No. 1,521,418. Dec. 30, 1924. John R. Ball, Durango, Colo. A two-compartment mill, one drum overhanging each trunnion bearing, the bearings being separated only by the drive pulley.

No. 1,522,808. Jan. 13, 1925. W. J. Coles, Sheffield, England, assignor of one-half to Edgar Allen & Co., Ltd., Sheffield, England. A cylindrical mill with a diaphragm dividing the mill into separate grinding or crushing compartments. The size of the apertures in the diaphragm may be adjusted from the outside.

No. 1,524,871. Feb. 3, 1925. P. T. Lindhard, Brooklyn, N. Y., assignor to F. L. Smidth & Co., New York City. A multiple-compartment ball mill adapted for stage grinding in one unit, the center compartments having an inner perforated shell to separate the fine from the coarse pulp.

No. 1,525,789. Feb. 10, 1925. J. S. Bartley, Denver, Colo. A cylindrical grinding mill with an inner shell and diaphragm forming a classifying compartment.

No. 1,525,790. Feb. 10, 1925. J. S. Bartley, Denver, Colo. A combination of a ribbed lining and a few tumbling rolls of triangular cross-section which mesh with the lining and with each other.

No. 1,525,919. Feb. 10, 1925. J. W. Cover, Seattle, Wash., assignor to Lode Dredge Co., Seattle, Wash. Design for

a rod mill, the rods being supported on interior rings, and the ends of the shell being conical.

Petroleum Drilling

No. 1,522,075. Jan. 6, 1925. John Penrod and R. D. Thompson, Okmulgee, Okla. An oil-well pump.

No. 1,522,197. Jan. 6, 1925. G. A. Macready, Los Angeles. A method for making production tests in well drilling.

No. 1,522,868. Jan. 13, 1925. L. A. Cruets, Longmont, Colo. Apparatus for removing drill bits from oil wells.

No. 1,522,891. Jan. 13, 1925. G. B. Louderback, Compton, Calif. A drilling bit.

No. 1,522,892. Jan. 13, 1925. G. B. Louderback, Compton, Calif. A well tool.

No. 1,524,158. Jan. 27, 1925. A. B. Steen, Houston, Texas, assignor to The Texas Co. A well pump.

No. 1,524,677. Feb. 3, 1925. W. N. Thompson, Tupman, Calif. Expansion joint for well casings.

No. 1,524,776. Feb. 3, 1925. F. W. Boland and Andrew Craig, Los Angeles. A deep-well rotary drill.

No. 1,525,176. Feb. 3, 1925. J. S. Givens, Fort Worth, Texas. Electric heating means for oil wells.

No. 1,525,368. Feb. 3, 1925. J. L. Cameron, Orange, Texas. An oil-well seal.

No. 1,525,582. Feb. 10, 1925. C. C. Hosmer, Huntington Beach, Calif. Packer for oil wells.

No. 1,525,656. Feb. 10, 1925. C. L. Redfield, Chicago. An oil-well heater.

No. 1,526,677. Feb. 17, 1925. R. A. Painter, Fort Worth, Texas. A rotary well drill.

No. 1,526,723. Feb. 17, 1925. A. J. Taylor, Perry, La., and J. W. Taylor, San Antonio, Texas; A. J. Taylor assignor to J. W. Taylor. Pumping apparatus for oil wells.

No. 1,526,748. Feb. 17, 1925. C. H. Herman, Oklahoma City, Okla. Rotary drilling apparatus.

No. 1,526,880. Feb. 17, 1925. G. W. Tannehill, Abernathy, Texas. A sucker rod.

No. 1,527,129. Feb. 17, 1925. T. R. Griffith, Corsicana, Texas. An oil-well tool.

Pneumatic Rock Drills

No. 1,521,721. Jan. 6, 1925. R. H. Smickle, Belvidere, N. J., assignor to Ingersoll-Rand Co., Jersey City, N. J. A retaining device for rock-drill steels.

No. 1,521,761. Jan. 6, 1925. Jesse Ditson, Littleton, Colo., assignor to Ingersoll-Rand Co. A drill sharpener.

No. 1,521,979. Jan. 6, 1925. Yuji Yamanouchi. Design for a rotating hammer drill.

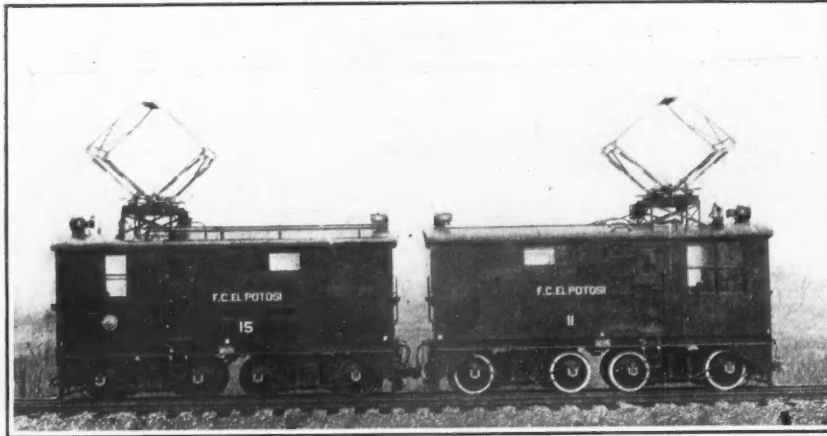
No. 1,522,239. Jan. 6, 1925. C. C. Hansen, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. A packing device for drill rods.

No. 1,522,240. Jan. 6, 1925. C. C. Hansen, Easton, Pa., assignor to Ingersoll-Rand Co. A rock-drill mounting.

No. 1,522,336. Jan. 6, 1925. F. M. Slater, Easton, Pa., assignor to Ingersoll-Rand Co. An air-feed brake for rock drills.

No. 1,523,253. Jan. 13, 1925. J. J. Brossoit, Salt Lake City, Utah. A method of construction of a drill bit.

New Machinery and Inventions



These locomotives recently placed in use by El Potosi Mining Co. are 25-ton 600-volt units, in tandem, and equipped for regenerative braking

El Potosi Company's New Industrial Locomotives Equipped for Regenerative Braking

WORK was recently completed on the substitution of electricity for steam by the El Potosi Mining Co. on its lead-silver property in the Santa Eulalia district in northern Chihuahua. The electrification includes the first application to be made of regenerative braking to a 600-volt railroad, and the locomotives are the first of the industrial type with regenerative braking equipment.

Electrical equipment for this change-over was furnished by the International General Electric Co. and includes transformer substations, high-voltage switching equipment, lightning arresters, switchboards, transformers, motors, motor generators, locomotives, and railway line material. The most interesting part of the work is the electrification of the railroad down the mountain to the mill and smelter, about 15 miles. The greater part of this road's service is hauling ore down from the mine to the mill and smelter. In addition to hauling the empty cars up the grade on the return trip, there is also some miscellaneous freight service. The weight of the train of ten loaded cars and locomotive is 262 tons. One hour is allowed for a one-way trip in either direction.

The track gage is 30 in., due to the fact that, under Mexican laws, a wider gage would have placed the road under the classification of a common carrier, with all the restrictions and regulations of government control. The average grade down the mountain is 3 per cent, and 2 per cent as the line reaches the lower levels of the smelter terminal. Curves are many and sharp. The maximum speeds allowable are 13 miles per hour on the upper length of the line and 20 miles as the train reaches the lower sections.

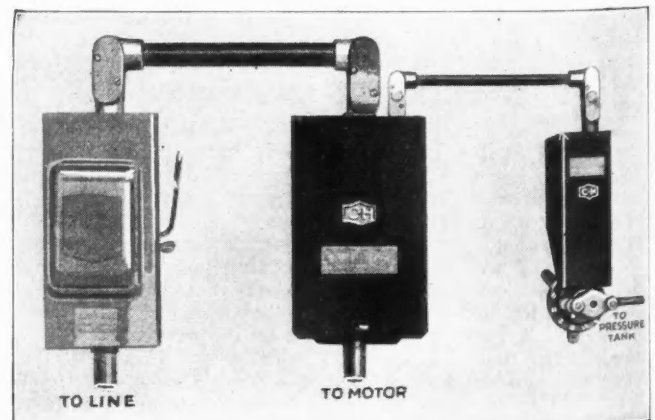
The five General Electric locomotives built for this service are 25-ton, 600-volt units equipped for regenerative braking and arranged for tandem operation in the form of a 50-ton locomotive for each train. Operating schedules call for one train an hour, both ascend-

ing and descending, the descending train thus furnishing part of the power for the ascending locomotive. The value of the power returned to the line, though important to the El Potosi Mining Co., is perhaps the least of the advantages of electric braking. Safety of train movements was the primary reason for its adoption.

The locomotives are of the double-swivel truck, box cab type with four motors, a motor on each axle. The regenerative braking equipment is similar to that used on main-line railroads, a motor generator being used to furnish excitation to the motors when functioning as generators. Both series and parallel braking connections are provided, giving a continuous range of braking speeds from 5 to 20 miles per hour.

The trolley wire is supported by General Electric bracket-type, direct-suspension construction. The rail bonds are electrically welded. Each of the three substations contains a standard 500-kw. synchronous motor generator arranged for power flow in either direction. Two ratchet type, alternating current watt-hour meters, one for recording in each direction, are provided on the switchboard at each of the substations.

A safe
arrangement
for
automatic
control
of a
small a.c.
single-phase
motor-driven
pump outfit



A Lock for Electric-Light Bulbs

A lock to prevent the theft of electric-light bulbs has recently been put on the market by the Ren Manufacturing Co., 553 Main St., Winchester, Mass. It consists of two parts, a coiled spring and a grooved ring. A special punch is used to attach it to the socket. The device can be used with standard electric light bulbs and standard brass, porcelain, and weather-proof sockets. When a lamp is locked in thus it cannot be removed except by breaking the glass. A special bag is provided for this purpose.

Pyrometer Design Modified

The suit brought by the Brown Instrument Co. in the Federal Court at Chicago against the Republic Flow Meters Co. and certain individuals has been settled between the parties; also certain suits at law brought by Republic Flow Meters Co. and the same individuals in the same court against Richard P. Brown have been dismissed.

The officers of Republic Flow Meters Co., the company has announced, did not wish to be under the imputation of illegally using any of the original constructions of the Brown Instrument Co. It having been called to their attention that there were pending on behalf of the latter company patent applications covering some of these features, to avoid controversy the Republic company has changed the construction of its indicating and recording pyrometers.

A Simple Way of Arranging Automatic Pressure Tank Control

The accompanying illustration shows a typical safe wiring and installation arrangement for the automatic control of a small a.c. single-phase motor-driven pump outfit. The main-line switch is of the inclosed outside-operated type mounted alongside of the Cutler-Hammer double pole magnetic switch and pressure-actuated switch. The latter is connected by pipe to the tank and electrically to the magnetic coil of the magnet switch, so that when the pressure in the tank drops to a predetermined low value the magnetic switch is caused to close, thus automatically connecting the motor on the line. When the pressure reaches the desired high value, the pressure switch opens, the magnetic switches drop out, and the motor and pump come to rest.

The Market Report

Daily Prices of Metals

Feb.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
19	14.375	56.50	57.00	9.20	9.00	7.50
20	14.375@14.50	56.50	57.125	9.20	9.00	7.55
21	14.375@14.50	56.375	57.00	9.20	8.95@9.00	7.60
23	.....	.....	.....	.....	.....	.....
24	14.375@14.50	56.375	57.00	9.20	8.90@8.95	7.55
25	14.375@14.50	56.375	57.00	9.175	8.825	7.50@7.55
Av.	14.425	56.425	57.025	9.195	8.945	7.545

*The prices correspond to the following quotations for copper delivered: Feb. 19th, 14.625c.; 20th to 25th, inc., 14.625@14.75c.

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

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

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

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

London

Feb.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
19	64 3/4	65 3/8	69 1/2	262 1/2	265 1/2	38	36 7/8	36 1/2	36 3/4
20	64 1/2	65 3/8	69 1/2	263 1/2	266	38 3/8	37 3/8	37 1/8	36 3/8
23	64 3/4	65 3/8	69 1/2	262 3/8	265 1/4	38	36 1/4	37 1/8	36 1/8
24	65	65 3/8	70	262 3/8	265 1/4	38 1/8	36 1/4	37 1/8	36 1/8
25	65	65 3/8	70	262 3/8	265 3/8	38 1/2	36 1/2	37 1/8	36 1/2

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

Silver, Gold, and Sterling Exchange

Feb.	Sterling Exchange "Checks"	Silver		Gold London	Feb.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
19	4.75 5/8	68 3/8	32 1/2	87s 1d	23	.....	...	32 5/8	87s 1d
20	4.76 1/2	68 3/8	32 1/8	86s 11d	24	4.75 3/4	68 1/2	32 3/8	86s 11d
21	4.75 3/4	68 3/8	32 1/4	.....	25	4.75 1/2	68 3/8	32 1/8	87s 0d

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

Metal Prices Hold Steady in Quiet Market

New York, Feb. 25, 1925—The market has been a very quiet one in all of the metals, throughout the week ending today, both here and in London. The holiday on Monday accentuated this condition. Prices have, however, held steady here, and all of the metals have advanced slightly in London over the quotations of a week ago. There seems to be no particular pressure to sell, by any of the producers, for they feel that so long as the foreign market holds up they will lose nothing by waiting until consumers again show inclination to enter the market.

Copper Slightly Stronger

The copper that was available at 14 1/2c. last week was quickly taken up, and all of the business in the East since last Thursday has been at either 14 3/4 or 14 3/8c. delivered, with 14 1/2c. secured on some business in the Middle West. Consumers showed little interest in the market, and most of the few sales that were made were the result of an active canvassing of prospects by producers. Brass companies in Connecticut were the chief factors in the business, but the total volume of sales was small. Most of the metal was for

April shipment. The export market was also lifeless, but sellers were unwilling to cut their prices much to attract buying. The price has been nominally around 14.65c., f.a.s., in the last day or two.

Most of the recent increase in production has come from United States mines.

Lead Prices Drop a Little

The contract price for New York lead, set by the American Smelting & Refining Co., continues at 9.25c. None of the producers report much business during the last week, which has been the dulllest so far this year. One small producer has cut under the Smelting company's price in the East, and has sold a few hundred tons down as low as 8 3/4c., New York, but most of the lead going to consumers has been on a contract basis at 9 1/4c. In St. Louis, the price has dropped somewhat below the 9c. level of last week, one producer quoting as low as 8.90c. yesterday and today, and another selling a round lot after cutting to 8.825c. today. The Chicago market has been about 9c., with no pressure to sell.

Most of the lead sold recently has been in small lots for immediate shipment, and it is probable that a good deal of March lead remains to be purchased. If so, this buying should appear soon now. Producers are also encouraged by the steady tone of the London market. Probably all Mexican and Canadian lead is being absorbed abroad, as present prices would hardly admit even ore lead except possibly for far forward delivery. Ultimate consumption continues excellent, and the recent lull in buying seems to be the result of a paring down of stocks by fabricators and consumers, owing to the price decline, rather than to any great decrease in the use of the metal. Some reselling of metal held by consumers is reported.

Zinc Steady Around 7 1/2c.

Zinc has advanced somewhat from the level of last week, sales again having been made above 7 1/2c. Yesterday, as high as 7.575c. was paid for a car of spot zinc, which commands a premium of about 5 points over that for March and April, as stocks are meager. Producers are in no mood to cut prices to attract trade so long as the present prices for ore continue; even the small producers seem to be sitting tight. The rise in foreign prices for zinc is encouraging, though the demand there has not amounted to much. Scarcely any American zinc can be sold for export at the present price parity. High-grade zinc continues unchanged at 8 3/4c. per lb., delivered in the East. New York prices on Prime Western, are, as usual, 35c. per 100 lb. above St. Louis.

Tin Remarkably Steady

The usual fluctuations in New York tin prices, under the lead of London, have been absent this week, all business for spot Straits having been booked at 57c. and 57½c., with about ¼c. higher asked for forward deliveries. Most of the business during the last week has been between operators, though consumers picked up a little of the metal yesterday when the price weakened slightly from the early quotations. Arrivals of tin to Feb. 24 totaled 6,115 long tons.

Foreign Exchanges Lower

Most of the important foreign exchanges had a quiet week, and prices are slightly lower in terms of the dollar. Closing cable quotations on Tuesday, Feb. 24, were: francs, 5.195c.; lire, 4.0525c.; and marks, 23.81c. Canadian dollars, ¼ per cent discount.

Silver Holds Steady

The silver market has held steady, with slight fluctuations, India being the chief buyer.

Mexican Dollars—Feb. 19th, 20th, and 21st; 52½c.; 23rd, holiday; 24th, 52¾c.; 25th, 52¾c.

Circulation Statement

The official statement of United States money in circulation on Feb. 1, 1925, is as follows:

Gold coin and bullion..	\$ 4,482,107,308
Gold certificates	(1,504,746,479)
Standard silver dollars.	516,619,851
Silver certificates	(432,291,204)
Treasury notes of 1890.	(1,400,677)
Subsidiary silver	283,309,190
United States notes....	346,681,016
Federal Reserve notes..	2,065,359,480
Federal Reserve Bank notes	8,275,193
National Bank notes ...	769,840,402

Total Feb. 1, 1925 ..\$8,472,192,440

Figures in parentheses are not included in the total.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

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

Antimony

Chinese brands, 20c. per lb.
Cookson's "C" grade, 22c.
Chinese needle, lump, nominal, 10c.
Standard powdered needle, 200 mesh, 11½@13c.

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

Bismuth—\$1.30@\$1.35 per lb., in ton lots. London, 5s.

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

Iridium—\$325 per oz.

Nickel—Ingot, 31c.; shot, 32c.; electrolytic, 38c.; London, £162½ per long ton.

Palladium—\$79@\$83 per oz. Crude, \$60@\$65.

Platinum—\$117 per oz. for refined. Crude, \$113.50@\$115.50.

Quicksilver—\$78.50 per 75-lb. flask. San Francisco wires \$80.15. Quiet. London, £12½.

The prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmiridium, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the prices given in the Feb. 7 issue.

Metallic Ores

Chrome Ore—Indian ore, \$21@\$22 per ton, c.i.f. Atlantic ports.

Tungsten Ore—Per unit, N. Y.:
Chinese wolframite, \$9.25@\$9.50.
High-grade Western scheelite, \$9.50 @\$9.75.

Iron Ore, Galena Radio Crystals, Manganese, Molybdenum, Tantalum, and Vanadium Ores are unchanged from Feb. 7 quotations.

Zinc Blende Higher—Lead Ore Lowered

Joplin, Mo., Feb. 21, 1925

Zinc Blende	Per Ton
High	\$57.85
Premium, basis 60 per cent zinc	\$56.00 @\$56.50
Prime Western, 60 per cent zinc	\$54.00
Fines and slimes, 60 per cent zinc	\$53.00 @\$50.00
Average settling price, all..	\$52.42

Lead Ore

High	\$140.80
Basis 80 per cent lead....	\$117.50
Average settling price, all...	\$129.46

Shipments for the week: Blende, 16,946; lead, 2,238 tons. Value, all ores, the week, \$1,088,010.

Settlements were made on lead ore from \$125 basis up to \$140 basis during the last week. Settlements on zinc blende ranged from \$50 to \$56.50 basis, the same range on which ore was purchased today for future delivery.

Purchases this month have been 12,940 tons on the 7th; 14,460 tons on the 14th, and 16,720 tons today; a total of 44,120 tons, based on dry weights delivered, or equivalent to a loaded tonnage of 48,530, an average of more than 16,000 tons per week. The wet tonnage production for the same period was 50,510 tons.

Platteville, Wis., Feb. 21, 1925

Zinc Ore	Per Ton
Blende, basis 60 per cent zinc....	\$55.50
Lead Ore	
Lead, basis 80 per cent lead.....	\$126.50

Shipments for the week: Blende, 763 tons; lead, 46 tons. Shipments for the year: Blende, 5,367; lead, 286 tons. Shipments for the week to separating plants, 1,095 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Beryl, Borax, Celestite, Chalk, China Clay, Corundum, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Ozocerite, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from Feb. 7 prices.

Mineral Products

Arsenious Oxide (white arsenic)—5¾c. per lb. Business has improved a

little, with reports from the South that the boll weevil promises to be more of a pest than last season. Inquiries are mostly for immediate shipment.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and Zinc Oxide are unchanged from Feb. 7 prices.

Ferro-Alloys

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

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and Ferrovandium are unchanged from the prices given in the Feb. 7 issue.

Metal Products

Rolled Copper—Sheets, 23c.; wire, 17c.

Zinc Sheets—Base price, 10.50c. per lb. with usual discounts and extras, f.o.b. La Salle, Ill.

Yellow Metal, Nickel Silver, and Lead Sheets are unchanged from Feb. 7 prices.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick, and Zirkite are unchanged from Feb. 7 prices.

Steel and Pig Iron Dull

Pittsburgh, Feb. 24, 1925

Though the talk in the trade is that steel buying is light, there have been fair bookings thus far this month, particularly from the West and Southwest, indicating good business in view of the extra heavy buying there had been in three preceding months, since the election.

In spots there is a tapering off in mill operations, but all such cases can be traced to the mills involved having produced and shipped more than was really requisite. Steel consumption is at a good rate and is increasing rather than decreasing.

The various steel price advances of the second half of January, which were contrived for the purpose of stimulating buying at the old prices, remain practically on paper, and there is a possibility they will eventually be forgotten.

There has been excess production of steel in the last three months, as buyers were replenishing stocks, and production is now in line for a decrease, but only to a slight extent, to reach the level of consumption, which averaged about 75 per cent of steel-making capacity in the last two years, and may run above that this year.

Pig Iron—The market is dull, with consumers apathetic as to making fresh engagements, and it looks now as if there would be no regular second-quarter contracting movement. Bessemer, \$22.50; basic, \$22; foundry, \$22@\$23, f.o.b. Valley furnaces, the basic quotation being practically nominal.

Connellsville Coke—Under pressure of light demand the market on spot has weakened farther, to \$3.50@\$3.75 on furnace and \$4.25@\$4.75 on foundry. There is no inquiry to bring out contract quotations.

Company Reports

Utah Copper Co.

A statement of the Utah Copper Co. for the fourth quarter of the fiscal and calendar year 1924 shows the following production:

Fourth Quarter, 1924		Third Quarter, 1924	
	Pounds		Pounds
October.....	17,635,180	July.....	17,489,781
November.....	17,849,316	August.....	17,931,493
December.....	17,845,936	September.....	17,832,571
Total.....	53,330,430		53,253,845

During the quarter the Arthur plant treated 1,387,000 dry tons of ore and the Magna plant 1,661,200 dry tons, a total for both plants of 3,048,200 dry tons.

The average grade of ore treated at the mills was 1.06 per cent copper and the average mill recovery of copper in the form of concentrates was 85.89 per cent of that contained in the ore, compared with 1.06 per cent copper and 87.24 per cent recovery, respectively, for the previous quarter.

The average cost per pound of net copper produced, including depreciation of plant and equipment, and all fixed and general expenses and after crediting gold, silver, and miscellaneous earnings, was 9c., compared with 9.4c. for the preceding quarter, computed on the same basis. The value of gold and silver recovered and the miscellaneous earnings amounted to 1.06c. per pound of copper, compared with 1.04c. for the previous quarter.

The following tabulation shows the financial results of the company's operations for the quarter, compared with the previous quarters of the year:

	Fourth Quarter 1924	Third Quarter 1924
Net profit from copper production.....	\$2,261,360.72	\$1,740,861.65
Miscellaneous income, including gold and silver.....	566,989.27	553,316.52
Bingham & Garfield Ry. Co. dividends.....		100,000.00
Total income.....	\$2,828,349.99	\$2,396,178.17
Depreciation.....	314,237.83	288,005.34
To surplus.....	\$2,514,112.16	\$2,108,172.83

Earnings for the fourth quarter are computed on the basis of 13.725c. per pound carrying price for copper, compared with 13.133c. for the third quarter, 12.853c. for the second quarter, and 12.782c. for the first quarter.

A quarterly distribution to stockholders of \$1 per share was made on Dec. 31, 1924, and amounted to \$1,624,490.

United Verde Extension Mining Co.

A report of operations of United Verde Extension Mining Co. for 1924 gives output as follows:

	Pounds
Copper produced from 185,858 dry tons of ore.....	44,278,947
Copper sold.....	45,462,053
Copper on hand Jan. 1, 1924.....	11,444,724
Copper on hand Jan. 1, 1925.....	10,261,618

To the westward in the United Verde Extension ground drifting has been continued steadily more or less on all the levels. These have not reached any additional veins more important than those encountered last year. The ground has been favorable and the work is being carried forward.

On the 1,600 and 1,700 levels, development southwest of the Edith shaft has encountered a body of low-grade pyrite, the extension northward of the main orebody. The work planned for 1925 may open this up further in new country.

Exploration in the Jerome Verde has been continued northward on the eastern side of the main fault almost to the northern boundary. This has so far not encountered anything of value, and work in this direction is abandoned. In the southern part of Jerome Verde ground, crosscuts to the east have been run more or less parallel to the haul-

age tunnel and drifts run on the most favorable streaks but without results of importance.

Advantage has been taken of the work in the Jerome Verde to make connection from the main orebody to the Columbia shaft in the south end of that property. This will give ventilation for a long drift south along a prominent cross fault which, from work on the 1,400 in an oxidized area, gives promise for ore on the 1,700.

The amount of ore developed above the 1,600 level is as follows: Estimated tonnage and average: 946,319 tons. Average content 10.53 per cent copper, 0.034 oz. gold, and 2 oz. silver. Costs were as follows:

	Per Pound
Mining.....	.0284
Smelting.....	.0261
Freight on ore.....	.0008
Freight on bullion, refining and selling.....	.0187
Other expenses.....	.0009
	.0749

These costs do not include depreciation, reserve to return of capital (depletion) or taxes.

Statement of Earnings

Gross revenue from metals and ore produced.....	\$6,308,624.47
Other revenue.....	314,866.99
	\$6,623,491.46
Deductions	
Mine and smelter operating, freight, refining and selling expenses.....	\$3,294,019.38
Other expenses.....	470,577.55
	3,764,596.93
Earnings.....	\$2,858,894.53
Less	
Amounts written off to reserves for depletion and depreciation.....	3,006,383.64
Net loss to surplus.....	\$147,489.11

Balance Sheet as at Dec. 31, 1924

Assets	
Mining property.....	\$34,879,243.89
Less depletion reserve.....	19,395,519.91
	\$15,483,723.98
Smelter plant, machinery, equipment and buildings.....	\$5,993,381.96
Less depreciation.....	3,938,272.93
	2,055,109.03
Investments, at cost.....	1,753,841.18
Lands and ranches.....	336,267.55
Accounts and notes receivable.....	222,985.00
Inventories of materials and supplies.....	312,899.45
Cash in banks and on hand.....	893,849.42
U. S. Treasury notes.....	100,000.00
Liberty bonds, at par.....	3,363,950.00
Due on metals sold, ore and bullion on hand.....	2,506,654.55
	\$27,029,280.16
Liabilities	
Capital stock, authorized.....	\$ 750,000.00
Less unissued stock.....	225,000.00
	\$ 525,000.00
Accounts payable.....	1,116,713.85
Reserve for liability insurance.....	112,192.14
Surplus—	
Balance Jan. 1, 1924.....	\$28,047,863.28
Deduct dividends paid out of reserve fund for depletion.....	2,625,000.00
	25,422,863.28
	\$27,176,769.27
Surplus account, no balance as at Jan. 1, 1924	
Net loss for 1924.....	147,489.11
	147,489.11
Deduct debt balance on surplus account.....	
	\$27,029,280.16

Iron Cap Copper Co.

During the fourth quarter of 1924 the production of the Iron Cap Copper Co. was 1,381,438 lb. of copper, 30,614 oz. of silver and 64.48 oz. gold.

Income for the quarter.....	\$160,498.99
Expense for the quarter.....	139,215.88
Gain.....	\$21,283.11

Since the last bulletin the Supreme Court of Arizona has handed down a decision concerning which counsel authorizes the company to say:

"As we construe the decision, it vests in the Iron Cap company absolutely all ores that have been mined by it prior to filing the suit in Arizona to quiet title, and to which the Arizona Commercial had asserted a claim.

"The decision as a whole is a victory for the Iron Cap company in that it sustains that company's right to all ores that have ever been extracted from its properties and which the Arizona Commercial was seeking to obtain in the Massachusetts and Maine litigation."

McIntyre Porcupine Mines, Ltd.

Gold, Ontario

A quarterly earnings statement of McIntyre Porcupine Mines, Ltd., for the six months ended Dec. 31, 1924, follows:

	First Quarter Sept. 30, 1924	Second Quarter Dec. 31, 1924	Six Months to Dec. 31, 1924
Gross recovery.....	\$903,790.27	\$885,570.90	\$1,789,361.17
Costs, including development.....	463,475.75	459,079.97	922,555.72
Operating earnings.....	\$440,314.52	\$426,490.93	\$866,805.45
Non-operating revenue.....	20,371.35	24,726.31	45,097.66
	\$460,685.87	\$451,217.24	\$911,903.11
Less provision for taxes for period...	32,313.88	29,579.57	61,893.45
Net earnings before plant depreciation	\$428,371.99	\$421,637.67	\$850,009.66

Nevada Consolidated Copper Co.

A report of operations of the Nevada Consolidated Copper Co. for the fourth quarter of 1924 states that production of copper for the quarter was 17,552,612 lb.

A total of 905,800 tons dry weight of Nevada Consolidated ore was milled and 1,424 dry tons of Ruth mine direct-smelting ore, averaging 6.42 per cent copper, was shipped to the smelter. Besides the company ores received, 9,530 dry tons of direct-smelting custom ores were received and treated at the smelter.

The average tenor of ore treated at the concentrator was 1.11 per cent copper, and the average mill recovery of copper in concentrates was 90.85 per cent, compared with 1.18 per cent heads and a recovery of 87.69 per cent for the previous quarter.

The cost of production, including charges for depreciation and all fixed and general expenses and after credit for gold and silver values and miscellaneous earnings, was 11.27c. per lb. of copper produced, compared with 11.42c. per lb. for the preceding quarterly period.

The financial outcome of operations is shown below:

	Fourth Quarter 1924	Third Quarter 1924
Operating gain from copper production.....	\$383,396.59	\$520,292.95
Value gold and silver and miscellaneous earnings....	206,736.20	166,991.71
Nevada Northern Ry. Co. dividend.....	100,000.00	100,000.00
Total income.....	\$690,132.79	\$517,284.66
Plant and equipment depreciation.....	150,429.72	150,429.72
Increase in earned surplus.....	\$539,703.07	\$366,854.94

Earnings for this fourth quarter are taken into account on the basis of 13.77c. per lb. of copper, compared with the carrying price of 12.98c., 12.85c., and 12.75c. for the third, second, and first quarterly periods, respectively.

Financial Notes of the Mining Companies

Seneca Copper—Stockholders' subscription to new stock at \$6 per share has been sufficient to make reorganization plan effective.

Anglo-Chilean Nitrate—Augustin Edwards, formerly ambassador from Chile to Great Britain, has been elected chairman of the board of Anglo-Chilean Consolidated Nitrate Corporation, a recently formed subsidiary of Guggenheim Bros.

United Verde Copper—All directors re-elected at annual meeting.

Yukon Gold—At organization meeting the following officers were elected: John K. MacGowan, president; O. B. Perry, vice-president and general manager; F. R. Foraker, vice-president; W. E. Bennett, secretary and treasurer.

Dome Mines—Dome Mines reported to have taken an option on 400 acres of property of Rouyn Goldpan Syn-

dicate, consideration being six semi-annual payments of \$100,000 each.

Tuolumne—The following were elected directors at annual meeting: W. P. Jahn, Milwaukee; Daniel Coleman, Arthur Perham, F. K. Wilson, J. J. Harrington, and John Harrington, of Butte; and T. E. Murray, of St. Paul.

Ray Hercules—The stockholders' Protective Committee appointed at a meeting held recently in Jersey City is composed of George J. Soper, Kirby Thomas, George H. Russel, W. H. Bartholomew, and Solomon Smith. The committee requests stockholders to deposit their stock in trust, with proxies to vote, with the New Jersey Corporations' Agency, 243-245 Washington St., Jersey City, N. J. William Sulzer, 115 Broadway, New York City, is general counsel for the stockholders' committee.

Another Substantial Advance in Dividends Paid in February

The following dividends were paid by American mining and metallurgical companies during February:

Companies in the United States	Situation	Per Share	Total
American Smelting & Refining.....	Various	\$1.50 Q	\$914,970
Anaconda Copper Mining.....	Various	0.75 Q	2,250,000
Colorado Fuel & Iron pfd.....	Various	2.00 Q	40,000
Davis-Daly Copper.....	Mont.	0.80 L	480,000
General Development.....	Various	0.25 Q	30,000
Homestake Mining, g.....	S. D.	0.50 M	125,580
International Nickel pfd., n.c.....	W. Va., Ont.	1.50 Q	133,689
Miami Copper.....	Ariz.	0.50 Q	373,557
New Cornelia Copper.....	Ariz.	0.25 Q	450,000
New Jersey Zinc.....	Various	2.00 Q	909,328
Superior Copper.....	Mich.	2.49 L	249,000
Tonopah Mining, s.g.....	Nev.	0.50 X	500,000
U. S. Steel pfd.....	Various	1.75 Q	6,304,919
United Verde Extension, c.....	Ariz.	0.50 Q	525,000
Companies in other countries			
Amparo Mining, g.s.....	Jalisco	0.02 Q	40,000
Aramayo Mines, s,t,b,c.....	Bolivia	Sw. fr. 1.25 Q	750,000
Asbestos Corporation.....	Quebec	\$2.00	\$60,000
British Platinum & Gold.....	Colombia	6d.	£14,915
Cerro de Pasco, c.s.....	Peru	\$1.00 Q	\$1,122,662
Hollinger Consolidated Gold.....	Ont.	0.05 4wks.	246,000
Total.....			\$14,754,705

g, gold; n, nickel; c, copper; s, silver; t, tin; b, bismuth; Q, quarterly; L, liquidation; M, monthly; X, extra.

Dividends for February have been about \$2,700,000 greater than those paid for the preceding quarter, in November, and \$4,340,000 greater than those paid in February, 1924. The American Smelting & Refining Co. increased its regular quarterly distribution from \$1.25 to \$1.50 a share. Anaconda resumed its old dividend of 75c. per share, last paid in January, 1924. The Asbestos Corporation, in Canada, paid twice as much on its common stock as it was doing when it ceased paying dividends on this issue in October, 1923; preferred dividends have continued in the meantime.

Two liquidation dividends were paid; that of the Davis-Daly is in addition to the payment of \$4 per share made in March, 1924, and is part of the proceeds of the sale of the properties to the Anaconda company for \$3,000,000 last year. Superior Copper received \$80,000 for the sale of its properties, to which was added \$169,000 received from the sale of securities and other assets. Tonopah made a special disbursement out of earnings prior to March 1, 1913.

Exportable Surplus of Copper Increases

Imports of copper into the United States have held steady for the last seven quarter years, but exports have increased greatly, as seen in the following table:

1923	Pounds		Exportable Surplus
	Imports	Exports	
First quarter.....	141,685,000	193,850,000	57,165,000
Second quarter.....	197,999,000	194,500,000	3,499,000
Third quarter.....	194,831,000	210,100,000	15,269,000
Fourth quarter.....	177,556,000	238,500,000	60,944,000
1924			
First quarter.....	206,160,000	271,300,000	65,140,000
Second quarter.....	198,728,000	308,610,000	109,882,000
Third quarter.....	176,887,000	277,860,000	101,173,000
Fourth quarter.....	195,196,000	319,830,000	124,632,000

These figures are compiled from U. S. Department of Commerce bulletins, and include all copper-bearing material reported, brass being considered as 80 per cent copper. In the last quarter of 1924 the exportable surplus averaged more than 41,000,000 lb. per month, the greatest in two years or more. Evidently, production of South American and African mines is not increasing so fast as European and other foreign consumption.

Current Prices of Mine Materials and Supplies

RISE AND FALL OF THE MARKET

During the month a decidedly firmer tendency has been noted in such items as: steel sheets and structurals; track supplies; clay products; linseed oil; rope; and flotation oils. Slight softening of the market occurred in steel pipe; timbers; lime; red and white lead; hose and belting.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Blue Annealed	\$2.70@2.80	\$3.90	\$3.80	\$4.20	\$3.89
Black	3.50@3.70	4.65	4.50	5.25	4.75
Galvanized	4.75@4.85	5.65	5.50	6.25	5.75

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh		Birmingham	Chicago
	Current	Year Ago		
Standard bessemer rails	\$43.00	\$43.00	\$43.00	\$43.00
Standard openhearth rails	43.00	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh		San Francisco	Birmingham
	Current	One Year Ago		
Standard spikes, 1/2-in. and larger	\$2.90	3.05@3.15	\$3.55	\$4.35
Track bolts	3.90@4.25	4.00@4.25	4.55	5.85
Standard section angle bars	2.75@2.85	2.75	3.30	4.00

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham, Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	\$2.00@2.20	\$2.05	\$3.34	\$4.15	\$3.25	\$3.10	\$3.15
Channel, 3 to 15 in.	2.00@2.20	2.10	3.34	4.15	3.25	3.10	3.15
Angles, 3 to 6 in., 1/2 in. thick	2.00@2.20	2.10	3.34	4.15	3.25	3.10	3.15
Tees, 3 in. and larger	2.00@2.20	2.10	3.34	4.15	3.25	3.10	3.15
Plates	2.00@2.20	2.00	3.34	4.15	3.25	3.10	3.15

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7 1/2%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope	+12 1/2%

Drill Rod (from list)

	New York	Cleveland	Chicago
	60%	55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Inches	Steel Black	Galv.	Inches	Iron Black	Galv.
BUTT WELD	1 to 3	62	50 1/2	1 to 1 1/2	30	13
LAP WELD	2 1/2 to 6	59	47 1/2	3 to 6	28	13

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	New York	Black Chicago	St. Louis
3 1/2 to 6 in. lap welded	48%	56 1/2%	46%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York		Birmingham	Chicago	St. Louis	San Francisco
	Current	One Year Ago				
6 in. and over	\$54.60@55.60	\$61.60@63.60	\$43@50	\$49.20@50.20	\$48.00	\$53.00

NUTS—Semi-finished, 1/2 x 1/2-in., 2c. each. Discount 70% for 3/4-in. and smaller; 65% for 1-in. and larger. Case hardened, 6c. each, less 50%.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York		Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J. Factory
	Current	One Year Ago					
4x12x12	\$0.1162	\$0.1179	\$0.06	\$0.125	\$0.078	\$0.108	
6x12x12	.1743	.1769	.0825		.104	.156	\$0.2388*
8x12x12	.2179	.2211	.1125	.215	.146	.244	.2956†

* 10x12x12; † 12x12x12.

MACHINE BOLTS—1/2 x 1/2-in., per 100, \$1.70. Discount at New York warehouses on all sizes up to 1 x 3/8-in., 45%.

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers at yards in San Francisco. To contractors, \$2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	\$28.00	\$29.00	\$30.00	\$33.00
3x6 and 8	28.00	29.00	30.00	33.00
4x4-6 and 8	28.00	29.00	30.00	33.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, \$5 additional.

	New York		Chicago	
	20 Ft. and Under	22-24 Ft.	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	\$45.00	\$46.00	\$	\$
3x10 to 10x10	48.00	49.00		
3x12 to 12x12	55.00	56.00		

Other Cities

	8 x 8-In. Pine	x 20 Ft. Fir*	and Under Hemlock	Spruce	12 x 12-In. Pine	and Under Fir*
Boston	\$52.00	\$50.00†	\$50.00	\$50.00	\$62.00	\$60.00†
Cincinnati	40.00	74.00	74.00	88.00	44.00	78.00
Denver		38.75	38.75			39.75
Minneapolis	42.00	39.75	39.00		44.50	39.75
Kansas City	42.50	31.00			53.50	32.00
Birmingham	32.00				34.00	

* Douglas fir. † Prime.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	\$2.85	\$3.25	\$4.00	\$4.50	\$3.18	\$4.95
Cut	2.90		5.25	5.00	3.28	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots without bags. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	\$2.50@2.60	\$2.50@2.60	\$2.50@2.60
Chicago, f.o.b.	2.20	2.10	2.20
Cleveland, f.o.b.	2.39	2.39	2.41

LIME—Warehouse prices:

	Hydrated, per Ton	Lump, per Barrel	280-lb. net
	Finishing	Common	Finishing
New York	\$18.20	\$12.00@13.10	\$3.50
San Francisco	22.00		\$2.50@2.75 (180-lb. net) 1.60

LINSEED OIL—These prices are per gallon:

	New York		Chicago	
	Current	One Year Ago	Current	One Year Ago
Raw in barrel (5 bbl. lots)	\$1.24	\$0.97	\$1.25	\$0.94

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry		In Oil	
	Current	1 Yr. Ago	Current	1 Yr. Ago
Red	16.25	15.00	17.75	16.50
White	16.25	15.00	16.25	15.00

HOSE—Quotations at New York warehouses:

	Fire Protection	50-Ft. Lengths
		Underwriters' 2 1/2-in. coupled, single jacket
	Air—Best Grade	56c per ft.
1/2-in., per ft.	3 ply \$0.33	4 ply \$0.40
	Steam—Discounts from List	
First grade	40%	Second grade 40-5% Third grade 40-10%

RUBBER BELTING—List price 6-in., 6 ply, \$1.83 per lin. ft. for rubber transmission belting.

Best grade 50-5% Second grade 50-10-5%

LEATHER BELTING—List price, 24c. per lin. ft. per inch of width for single ply at New York warehouses:

	Discount from list
Medium	40-2 1/2%
Heavy	30-5%

RAWHIDE LACING

For cut, best grade, 45-5%, 2nd grade, 55%
For laces in sides, best, 41c. per sq. ft.; 2nd, 37c.
Semi-tanned: cut, 45-5%; sides, 41c. per sq. ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, 1/2 in.	\$0.90
Rubber sheet	.45
Rubber sheet, wire insertion	.70

MANILA ROPE—Per lb., 1/2-in. and larger, 1,200-ft. coils.

Atlanta	\$0.23	New Orleans	\$0.23 1/2
New York	.22	Seattle	.17
Chicago	.21 1/2	San Francisco	.23

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin	
	40%	60%
New York	\$0.27	\$0.295
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.22	.245
New Orleans	.235	.26
San Francisco	.1625	.1925

FLOTATION OIL

Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal.	\$0.32
---------------------------------------------------------------------------------------	--------

CHEMICALS

Zinc dust, 550 lb. casks, f.o.b. Palmerton, Pa., per lb.	\$0.08 1/2
Litharge, f.o.b. New York, kegs, per 100 lb.	16.75
Sodium cyanide, 220 lb. single case lots, f.o.b. New York, per lb.	.19@.22

Mining Stocks

Week Ended February 21, 1925

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Alaska-Br. Col.	N. Y. Curb			*6	
Anaconda	New York	44 1/2	41	43 1/2	Ja. 17, Fe. 16, 0.75
Arcaidian Consol.	Boston	2 1/2	1 1/2	1 1/2	
Ariz. Com'l.	Boston	13 1/2	12 1/2	13 1/2	Ja. 19, Ja. 31 0.50
Calaveras	N. Y. Curb			2	
Calumet & Arizona	New York	52 1/2	51	51 1/2	Mh. 6, Mh. 28 Q 0.50
Calumet & Hecla	Boston	16 1/2	15 1/2	15 1/2	Ja. 30, Mh. 4 0.50
Canario Copper	N. Y. Curb	4	3 1/2	4	
Cerro de Pasco	New York	53 1/2	50 1/2	52 1/2	Ja. 22, Fe. 2, Q 1.00
Chile Copper	New York	36	34 1/2	35 1/2	Mh. 3, Mh. 20, Q 0.62 1/2
Chino	New York	26	24 1/2	26	Sept., 1920 0.37 1/2
Con. Coppermines	N. Y. Curb	3 1/2	3 1/2	3 1/2	
Copper Range	Boston	28 1/2	26 1/2	28 1/2	May, 1924 1.00
Crystal Copper	Boston Curb	*63	*61	*62	
Davis-Daly	Boston			*78	Mar., 1920 0.25
East Butte	Boston	5 1/2	5	5 1/2	Dec., 1919 0.50
First National	Boston Curb	*35	*32	*33	Feb., 1919 0.15
Franklin	Boston	1 1/2	1 1/2	1 1/2	
Gadsden Copper	Boston Curb	*65	*65	*65	
Granby Consol.	New York	19 1/2	18 1/2	19 1/2	May, 1919 1.25
Greene-Canaan	New York	17 1/2	16 1/2	16 1/2	Nov., 1920 0.50
Hancock	Boston	1 1/2	1 1/2	1 1/2	
Howe Sound	N. Y. Curb	4	3 1/2	3 1/2	April 1924 0.05
Inspiration Consol.	New York	29	26 1/2	28 1/2	De. 20, Ja. 7, Q 0.50
Iron Cap	Boston Curb	2 1/2	2 1/2	2 1/2	May, 1923 0.15
Isle Royale	Boston	17	16	16 1/2	Sept. 1923 0.50
Jerome Verde Dev.	N. Y. Curb	1 1/2	1 1/2	1 1/2	
Kennecott	New York	54 1/2	51 1/2	54	Mh. 6, Ap. 1, Q 0.75
Keweenaw	Boston			*75	
Lake Copper	Boston	2	2	2	
Magma Copper	New York	40 1/2	38 1/2	39 1/2	Jan., 1919 0.50
Mason Valley	N. Y. Curb	2	1 1/2	2	
Mass Consolidated	Boston			1	Nov., 1917 1.00
Miami Copper	New York	22 1/2	21 1/2	21 1/2	Fe. 2, Fe. 16 Q 0.50
Mohawk	Boston	36 1/2	35	36	Ja. 13, Mh. 2 1.00
Mother Lode Co.	New York	8 1/2	7 1/2	8	De. 12, De. 31 0.37 1/2
Nevada Consol.	New York	15 1/2	14 1/2	15 1/2	Sept., 1920 0.25
New Cornelia	Boston	22 1/2	21 1/2	22 1/2	Fe. 6, Fe. 23 0.25
New Dominion	Boston	*85	*50	*70	
North Butte	Boston	2 1/2	2 1/2	2 1/2	Oct., 1918 0.25
Ohio Copper	N. Y. Curb	1 1/2	1 1/2	1 1/2	Nov. 14, De. 2 0.05
Old Dominion	Boston	24 1/2	23 1/2	24	Dec., 1918 1.00
Phelps Dodge	Open Mar.	112 1/2	112		De. 2, Ja. 2 Q 1.00
Quincy	Boston	32 1/2	30	32 1/2	Mar., 1920 1.00
Ray Consolidated	New York	16 1/2	15	15 1/2	Dec., 1920 0.25
Ray Hercules	N. Y. Curb			*8	
St. Mary's Min. Ld.	Boston	43 1/2	40 1/2	42 1/2	May 1924 3.00
Seneca Copper	New York			1	
Shannon	Boston	1 1/2	1 1/2	1 1/2	Nov., 1917 0.25
Shattuck Arizona	New York	7	6 1/2	6 1/2	Jan., 1920 0.25
Superior & Boston	Boston	1 1/2	1 1/2	1 1/2	
Tenn. C. & C.	New York	9	8 1/2	8 1/2	De. 31, Ja. 15, Q 0.25
United Verde Ex.	N. Y. Curb	28	26 1/2	26 1/2	Ja. 2, Fe. 2 0.50
Utah Copper	New York	90 1/2	87	90	De. 12, De. 31, Q 1.00
Utah Metal & T.	Boston	*88	*69	*88	Dec., 1917 0.30
Victoria	Boston	*80	*60	*60	
Walker Mining	N. Y. Curb	3 1/2	3 1/2	3 1/2	
Winona	Boston			*25 1/2	
NICKEL-COPPER					
Internat. Nickel	New York	27 1/2	25 1/2	27	March, 1919 0.50
Internat. Nickel pfd.	New York	97	97	97	Ja. 15, Fe. 2, Q 1.50
LEAD					
Carnegie Lead & Zinc	Pittsburgh	7 1/2	6 1/2	7 1/2	
National Lead	New York	164 1/2	155 1/2	159 1/2	Mh. 13, Mh. 31, Q 2.00
National Lead pfd.	New York	117 1/2	117 1/2	117 1/2	Fe. 2, Mh. 14, Q 1.75
St. Joseph Lead	New York	41 1/2	39 1/2	41 1/2	Mh. 5, Mh. 20 0.50
ZINC					
Am. Z. L. & S.	New York	10 1/2	9	9 1/2	May, 1920 1.00
Am. Z. L. & S. pfd.	New York	33	31 1/2	32 1/2	Nov., 1920 1.50
Butte C. & Z.	New York	7 1/2	7 1/2	7 1/2	De. 10, De. 24 0.50
Butte & Superior	New York	20	18	19 1/2	June, 1923 0.50
Callahan Zn-Ld.	New York	4 1/2	3 1/2	4 1/2	Dec., 1920 0.50
New Jersey Zn.	N. Y. Curb	191	190	190 1/2	Ja. 20, Fe. 10 2.00
United Zinc	N. Y. Curb			*15	
Yellow Pine	Los Angeles	*72	*72	*72	De. 10, De. 15 Q 0.04
SILVER					
Alvarado	Boston Curb	1	1	1	Oct. 1920 0.50
Beaver Consol.	Toronto	*34 1/2	*31 1/2	*33 1/2	May, 1920 0.03
Castle-Trethewey	Toronto	*78 1/2	*75	*76	
Comagias	Toronto	2.05	2.00	2.00	May, 1924 0.12 1/2
Keeley	Toronto	2.25	2.22	2.24	Mh. 1, Mh. 15 SA 0.12
Kerr Lake	N. Y. Curb	1 1/2	1 1/2	1 1/2	Oct. 1, Oct. 15, 0.12 1/2
La Rose	Toronto	*48	*37 1/2	*43 1/2	Apr., 1922 0.10 1/2
Lorrain Trout Lake	Toronto	1.15	1.15	1.15	
McKinley-Dar-Sav.	Toronto	*22 1/2	*21 1/2	*22	Oct., 1920 0.03
Mining Corp. Can.	Toronto	2.70	2.65	2.65	Sept., 1919 0.12 1/2
Nipissing	N. Y. Curb	6 1/2	6 1/2	6 1/2	Ja. 18, Ja. 20, QX 0.30
Ontario Silver	New York			5 1/2	Jan., 1919 0.50
Temiskaming	Toronto	*29	*23	*26 1/2	Jan., 1920 0.40
GOLD					
Alaska Juneau	New York	1 1/2	1 1/2	1 1/2	
Argonaut	Toronto	*44	*41	*43 1/2	
Carson Hill	Boston	*45	*40	*40	
Consol. W. Dome L.	Toronto	*17	*16 1/2	*16 1/2	
Cresson Consol. G.	N. Y. Curb	4	3 1/2	3 1/2	De. 31, Ja. 10 Q 0.10
Crown Reserve	Toronto	*47	*43 1/2	*45	Jan. 1917 0.05
Dome Mines	New York	15 1/2	15	15 1/2	De. 31, Ja. 20, Q 0.50
Golden Cycle	Colo. Springs			1.47	Dec. 11, 1924 0.03
Hollinger Consol.	Toronto	14.65	14.55	14.60	Fe. 9, Fe. 26, M 0.05
Homestake Mining	New York	4 1/2	4 1/2	4 1/2	Fe. 20, Fe. 25, M 0.50
Jib. Cons l.	N. Y. Curb	*35	*27	*29	
Kirkland Lake	Toronto	*44 1/2	*43	*44 1/2	

Stock	Exch.	High	Low	Last	Last Div.
Lake Shore	Toronto	5.96	5.40	5.90	Mh. 2, Mh. 16, 0.05
McIntyre-Poreupine	New York	18	17 1/2	18	Fe. 2, Mh. 2, 0.25
Newray	Toronto	*30	*25 1/2	*27 1/2	
Night Hawk Pen.	Toronto	*30	*30	*30	
Portland	Colo. Springs	*45	*45	*45	Oct., 1920 0.01
Rand Mines	New York	35 1/2	35 1/2	35 1/2	Fe. 17, Fe. 25 1.79
Teck-Hughes	Toronto	1.41	1.36	1.38	
Tom Reed	Los Angeles	*62 1/2	*59	*62	Dec., 1919 0.02
Tough-Oakes	Toronto	*39 1/2	*37 1/2	*39	
United Eastern	N. Y. Curb	*63	*55	*55	July, 1924 0.05
Vipond Cons.	Toronto	1.27	1.25	1.26	
Wright-Hargreaves	Toronto	4.87	4.76	4.86	De. 15, Ja. 2, QX 0.05
GOLD AND SILVER					
Black Oak	N. Y. Curb			*81	
Con. Cortez	N. Y. Curb	*18	*10	*16	
Con. Virginia	San Francisco	6 1/2	5 1/2	5 1/2	
Continental Mines	N. Y. Curb			1 1/2	July, 1923 0.05
Dolores Esperanza	N. Y. Curb	*75	*60	*60	De. 22, Ja. 5, QX 0.10
Premier Gold	N. Y. Curb	2 1/2	2 1/2	2 1/2	Apr., 1923 0.05
Tonopah Belmont	N. Y. Curb	*57	*56	*57	Se. 22, Oc. 10 0.10
Tonopah Divide	N. Y. Curb			2 1/2	Mh. 11, Ap. 1, Q 0.05
Tonopah Extension	N. Y. Curb	3 1/2	2 1/2	2 1/2	Fe. 12, Fe. 25, 0.50
Tonopah Mining	N. Y. Curb	1 1/2	1 1/2	1 1/2	
Unity Gold	N. Y. Curb	*70	*55	*60	
West End Consol.	N. Y. Curb			*46	Mar., 1923 0.05
Yukon Gold	N. Y. Curb			*50	June, 1918 0.02
SILVER-LEAD					
Ahumada	Boston Curb	10 1/2	9 1/2	9 1/2	De. 15, Ja. 2, X 0.15
Bingham Mines	Boston	36	34 1/2	34 1/2	Mh. 20, Mh. 31 0.50
Cardiff M. & M.	Salt Lake	1.45	1.45	1.45	De. 16, No. 18 0.10
Chief Consol.	Salt Lake			3 1/2	May, 1924 0.10
Columbus Rexall	Salt Lake	*26	*25 1/2	*25 1/2	Aug., 1923 0.05
Erupeion	Boston Curb	3 1/2	3 1/2	3 1/2	De. 15, Ja. 2, X 0.15
Federal M. & S.	New York	21 1/2	20 1/2	20 1/2	Fe. 26, Mh. 15, Q 1.75
Federal M. & S. pfd.	New York	61 1/2	60	61 1/2	No. 25, De. 15, 1.75
Florence Silver	Spokane	*4 1/2	*4	*4	Apr., 1919, QX 0.01
Hecla Mining	N. Y. Curb	15 1/2	14 1/2	14 1/2	Fe. 15, Mh. 15 0.50
Iron Blossom Con.	Salt Lake	*32	*31 1/2	*31 1/2	Oct. 25, 1924 0.02
Iron King Mining	Salt Lake	*80	*80	*80	
Keystone Mining	Salt Lake	*80	*74	*76	
Mammoth Mining	Salt Lake	1.20	1.00	1.10	
Marsh Mines	N. Y. Curb			*6	June, 1921 0.02
Park City	Salt Lake	5.30	5.10	5.30	De. 15, Ja. 2 0.15
Park Utah	Salt Lake	4.05	3.95	3.95	April, 1924 0.15
Prince Consol.	Salt Lake	*25 1/2	*23 1/2	*25 1/2	
Silver King Coal	Salt Lake	6.10	5.90	6.05	De. 20, Ja. 2, Q 0.20
Silversmith	Spokane	*30	*29 1/2	*30	Ja. 1, Ja. 10 0.02
Tamarack-Custer	Spokane	*93	*83	*93	Se. 22, Se. 29 0.25
Tintic Standard	Salt Lake	9.10	9.00	9.10	Ja. 2, QX 0.50
Utah-Apex	Boston	7	6 1/2	6 1/2	Ja. 10, Ja. 15, 0.25
IRON					
Bethlehem Steel	New York	48 1/2	45 1/2	47 1/2	Jn. 1, Jy. 1, Q 1.25
Char. Iron	Detroit			*20	
Char. Iron pfd.	Detroit			*80	
Colorado Fuel & Iron	New York	45 1/2	41	43 1/2	May, 1921 0.75
Gt. North'n Iron Ore	New York	38	35 1/2	37	De. 10, De. 27 2.00
Inland Steel	New York	47	45 1/2	46 1/2	Fe. 14, Mh. 20 Q 0.625
Mesabi Iron	N. Y. Curb	4 1/2	3 1/2	3 1/2	
Replogle Steel	New York	18 1/2	16	17 1/2	
Republic I. & S.	New York	53 1/2	49 1/2	53	May, 1921 1.50
Republic I. & S. pfd.	New York	93	91	93	Mh. 8, Ap. 1, Q 1.75
Sloss-Sheffield S. & I.	New York	91 1/2	86	90 1/2	Mh. 10, Mh. 20, Q 1.75
Sloss-Shef. S. & I. pfd.	New York	97 1/2	97	97	Mh. 20, Ap. 2, Q 1.75
U. S. Steel	New York	125 1/2	122 1/2	124	Fe. 28, Mh. 30, QX 1.75
U. S. Steel pfd.	New York	123 1/2	122 1/2	122 1/2	Fe. 1, Fe. 27, Q 1.75
Virginia I. C. & C.	New York	40	40	40	De. 15, Ja. 2 1.50
Virginia I.C.&C.pfd.	New York			79	De. 13, Ja. 2, Q 2.50
VANADIUM					
Vanadium Corp.	New York	28 1/2	26 1/2	28	Jan., 1921 1.00
ARSENIC					
Western Utah Copper	N. Y. Curb	*25	*22	*22	
ASBESTOS					
Asbestos Corp.	Montreal	43 1/2	42	43	Fe. 1, Fe. 15 Q 2.00
Asbestos Corp. pfd.	Montreal	83 1/2	80 1/2	83 1/2	Ja. 2, Ja. 15, Q 1.50
SULPH					