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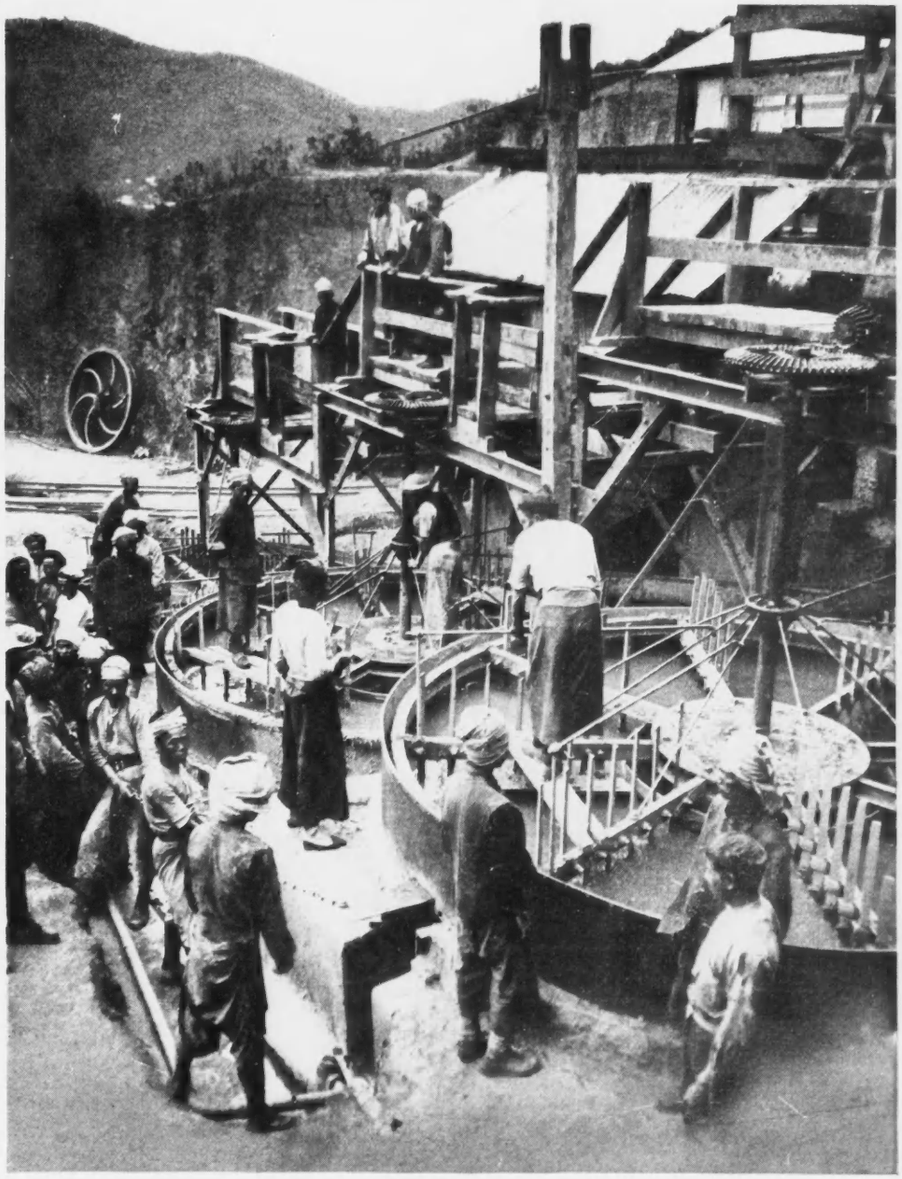
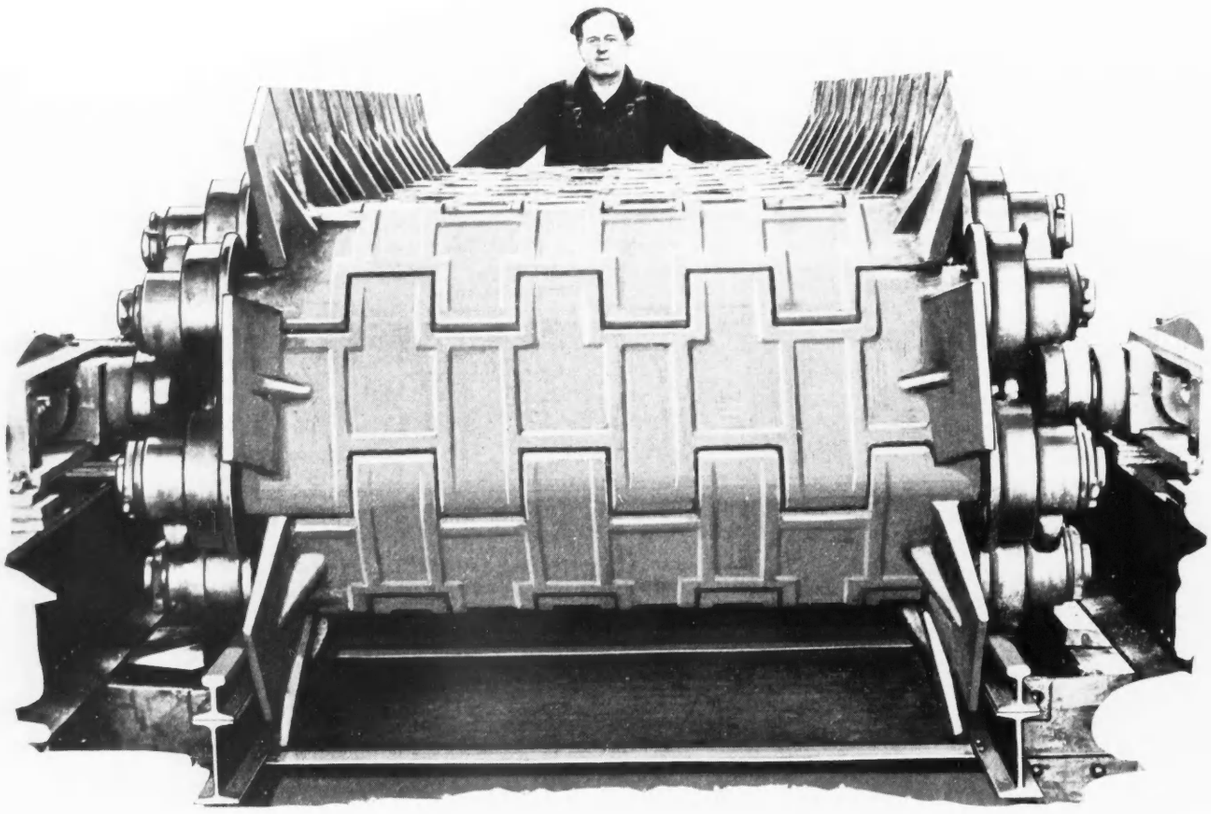


Development of the Rotary Pipe Conveyor, by Edward W. Davis—Synopsis of a Theory of Metallogeny, by Juan Hereza y Ortuño—Marketing of High Grade Clays, by Felix Edgar Wormser—Biography of George H. Dern, Governor of Utah



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ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 119 New York, January 24, 1925 *Number* 4

Lead Goes Skyrocketing

AGAIN the lead market is going through one of those periodic movements which carry the price of the metal to unusually high points. As this is written, lead is being sold in New York for 10.50c. per lb., a level that can only be compared with war peak prices. In fact, one has to go as far back as 1917 to find any parallel. Then lead sold for as high as 12c. per lb., but not for very long. The top of the present movement is not yet apparent, and should the strong demand for the metal continue, without an increase of production, the old record may be broken. Despite all the talk about diminishing lead reserves and the lack of new sources of production, it is noteworthy that last year's output of lead in the United States broke all records—an entirely unlooked-for event. A continued high price for lead will result in even this record being smashed; for one must not lose sight of the fact that the high price of lead is bringing its own corrective in the shape of increased production and lowered consumption. Although new lead mines may be scarce, many producing properties can increase their output without great difficulty. Already an added supply of lead is promised from the Cœur d'Alenes.

The high price of lead has the effect of greatly enlarging the reserves of most lead mines. Mineralized rock which cannot be handled profitably in a 5c. lead market may become ore in a 9 or 10c. lead market. In other words, the higher the price of lead rises, the greater the supply of marginal ore—ore that is on the border line of being profitable or unprofitable to treat. Furthermore, intensive prospecting of lead deposits should be a sequel of the high lead price and may result in important new discoveries.

At the same time consumption of lead is being affected by the prevailing prices. Reports of the substitution of aluminum for lead in foil manufacture have been made. Zinc pigments may supplant some of the lead used in paint, although, in this connection, it is interesting to note that an increase of 2c. per lb. in the price of lead bullion causes an advance of only 1½ per cent in the cost of painting a building, according to the calculations of an important paint manufacturer. Labor is the principal item in the cost of painting—much more than the cost of the paint itself. Several manufacturers are known to be working upon the development of substitutes for lead in industrial applications, but their efforts have not been very productive to date. Lead has a combination of valuable properties that make it a difficult commodity to replace.

Some consumers have naturally been disturbed about the high price of lead, and at least one has gone so far as to accuse the producers as being responsible for the present market—a ridiculous assertion, as even a cursory examination of the lead position would indicate. If any effort has been made to lift the price of lead it has been done abroad. In the present advance London has set the pace; New York and St. Louis have followed: At times the London and New York markets have been practically at a parity despite the tariff of 2½c. per lb. which protects the domestic market. This is certainly an indication that American producers have not pushed the market to the limit, as it would be an easy matter to establish the tariff differential. On the contrary, lead has been sold time and again by large interests at substantial concessions below the price received by smaller factors in the market.

The rise in the price of lead would be satisfactory to nearly every one if there were promise of its maintenance. A steady market price is beneficial to every one but a speculator. Producers and consumers can make intelligent plans with a steady lead market. Violent fluctuations upward or downward always bring in their wake a train of events that cause much annoyance to both parties. The present movement is no exception.

Business or Profession?

THE SUBJECT OF ETHICS among mining engineers is one that is brought forth periodically, viewed with head shakings and mental reservations, and returned to the locker. One class of solvers always comes forward with the statement that all that is necessary is to be honest and that no rules or fixed principles are required. But consciences of men differ more than the shapes of their noses.

Some very pertinent observations on this subject were made in the presidential address of the retiring president of the Mining and Metallurgical Society of America, at the annual dinner on Jan. 13. Mr. Leggett tended to encourage, if he did not support, certain definite ideas on this subject. One is, to allow ourselves to put it briefly, that mining is a business, not a profession. The mining engineer is hard to distinguish from the mining man: a good part of those present at the annual dinner of the society were none too familiar with the underground side of mining or the principles of ore deposits. This is apropos of perhaps one of the most mooted points of ethics for the "mining engineer," as to whether he should participate in a business way in mining enterprises, especially those with which he happens to be connected. Mr. Leggett narrated a story of a group of men of another type in which a similar theory was brought forth—that a man could not give an honest opinion concerning a property or business in which he himself was implicated: whereupon another speaker at the meeting, starting his rebuttal, addressed the group as "fellow criminals." An analogy between this other group and the engineers of the Mining and Metallurgical Society might have been sensed here. As a matter of fact, if mining is a

business and not a profession, is it sensible for a business man to refrain from a pecuniary interest in the business in which his life work is engaged? There are, nevertheless, engineers who believe and practice the contrary: and here we have a clear-cut issue which has skulked too long in the background; so that even if no agreement has been reached, the number of reputable engineers who have engaged in the business of mining, and prospered more or less (and without losing, as a matter of fact, any respect or honor whatever among their fellow engineers), is large enough to merit the humorous appellation of "fellow criminals."

Our own views may be frankly stated: they accord with those of Mr. Leggett—that mining is a business, and that it is as proper for an engineer to engage in it as it is for a bank cashier or president to acquire a financial interest in his bank or in other banks. More than that, we urge engineers to do this, so as not to leave the business of mining to lawyers, bookkeepers, and men of all types who otherwise become the governing force in mining, the employers of engineers, and the guiding factors in mining policies. Let the engineers frankly go after the business and get it if they can. The occupation of sitting in an office and waiting for clients to call for consultation is one which is rapidly becoming anachronistic.

Promising Improvement in the Parkes Process of Lead Refining

IMPROVEMENTS IN LEAD REFINING, as mentioned briefly in our last issue in the review of pyrometallurgy, have been of considerable importance in the last year or two. The use of caustic potash to remove impurities in lead bullion is not new, but the commercial application of the idea and the use of accessory reagents and equipment is a recent development. In the department devoted to recent technical publications in this issue we present the essential features of a patent which will be issued this month to F. F. Colcord, vice-president of the U. S. S. Lead Refinery at East Chicago. Sulphur is first stirred into the bullion, forming a copper dross which is removed after increasing the temperature of the metal. Caustic soda is then stirred in, with a further increase in temperature, forming sodium arsenate, which is skimmed off, thus removing the arsenic that is in the lead.

The advantage of removing copper in a single operation, compared with liquation and the removal by zinc, as in the Parkes process, is readily seen. The removal of arsenic with caustic soda takes place without the removal of any appreciable amount of antimony, so that the process seems of particular merit in purifying antimonial lead. Another advantage, and one which particularly distinguishes this process from another developed in England, and about which little is known, is that no special apparatus is necessary for its operation; any Parkes process plant has kettles, stirrers, and presses, which can be used without any change.

It would appear that Mr. Colcord and his associates at East Chicago have made an important step forward in the metallurgy of lead, and our readers may expect further details of work at this plant, and the application of the Colcord process at other refineries.

Trade Associations and the Department of Justice

THE REPORT of the Attorney General of the United States for 1924 contains a summary from the anti-trust division, written by Mr. Seymour, assistant to the Attorney General. This summary reflects, it would seem, a changed and more rational attitude toward trade associations than that which existed in the time of Attorney General Daugherty. Mr. Seymour speaks, as belonging to the work of the anti-trust division, of "the selection and prosecution of cases involving the organization and activities of trade associations." He goes on to observe that "practically every industry has its trade association. Many of these are operating along lines which are entirely lawful and of considerable benefit to the members and to the public; some are groping in the twilight zone of illegality; a few are wholly illegal. Cases involving conscious illegality have been energetically prosecuted. The main purpose, however, has been to center attention upon a number of well-chosen cases, which, when finally determined, will define with greater certainty the activities to which such associations may not resort, and on the other hand, aid honest business men to determine what measure of co-operation they may lawfully adopt."

American business men will welcome this spirit, which aims to be constructive as well as destructive. The administration of the former Attorney General (Daugherty) rejected the theory that constructiveness had any place in the function of the Department of Justice. Subordinates, indeed, stated explicitly, when interrogated, that the only duty of the department in regard to trade associations was to prosecute evident or even probable infringements of the anti-trust laws; and that it was not the purpose of the department to advise the business men of the country how far they could go in the organization of mutual benefit associations. It is gratifying that Attorney General Stone has taken a more benevolent attitude.

Further Use for Quicksilver

TWICE within the last eighteen months mercury has found the spotlight, each time in a rather sensational way. Just as a great poet once awoke to find himself famous, so quicksilver has had greatness thrust upon it for a moment through the kind offices of the daily press. First came the Emmet mercury boiler—an interesting development and marking real progress in the design of power-plant equipment. Apparently the conclusion was immediately reached by some that a boiler without mercury was doomed to be scrapped and that the demand for quicksilver would be enormous. However, the market did not run away, as an average price of $69.76 per 75-lb. flask in 1924 compared with $66.50 in 1923 bears witness. Then on the stage stepped Professor Miethe in the rôle of a converter of base mercury into precious gold—alchemy up to date. As yet the Berlin scientist has not proved his case, nor would it avail much if he had, and the gold standard remains unshaken.

A new use has now been discovered for quicksilver, as practical as that in connection with the Emmet boiler and as little likely to upset the market. A process for making cast-iron pipe centrifugally has been developed, in which by the use of mercury vapor in the hollow mold

a soft gray iron casting is said to be produced directly, avoiding the need for annealing or heat-treating the casting after it leaves the mold. For a battery of three to five casting machines about 100 lb. of mercury is required, none of which should be lost if the process works as planned, the vapor being ultimately condensed. Many of those who went to Birmingham with the Institute in October were interested to see cast-iron pipe made centrifugally by another process in which annealing was required. Whether the new method will be able to compete remains to be demonstrated.

Mining Engineer Becomes Governor

WITHOUT having examined the records carefully, we are inclined to believe that no mining engineer except Emmet D. Boyle, Governor of Nevada several years ago, had ever been chief executive of any state prior to the inauguration of George H. Dern as Governor of Utah on Jan. 6. Mining "men" have had the honor in several of the Western states at various times, but their connection with mining has been on the financial rather than on the engineering side. On page 156 of this issue we give a brief sketch of Governor Dern's career. His long and excellent record for efficient and economical operation as general manager of the old but well-known Consolidated Mercur Gold Mining Co. in Utah was one of the things that convinced the people of Utah that he could administer their affairs with a like efficiency and economy. Like "Al" Smith of New York, George Dern, of Utah, was the only Democrat on his state ticket to be elected.

We have urged repeatedly that engineers assume a more active part in the civic and political affairs of the country; that they bring their trained analytical minds to the solution of the problems of government. In the few instances in which they have, outstanding success has been attained. We hope that the honor accorded Mr. Dern may be a symptom of a growing tendency for participation in government affairs.

Conventions We Have Known

A MINING CONGRESS makes a congregation of Pollyannas look like the blues, remarked a woman writer recently in discussing a recent convention in a northwestern newspaper. The lady spoke to the point. But she was only partly right. Some mining conventions do and some don't. Sometimes they very much resemble a chamber of commerce meeting, where unreasoning optimism is the keynote and boosting the order of the day, and where anyone who fails to keynote properly is looked upon as a disturber of the peace.

But on the other hand there was the Mining Congress in Denver, for instance, in 1920, which was a real sure-enough convention, where mining men came together to talk over their troubles. The conference on flotation litigation was marked by fireworks that made the affair a memorable one, and other sessions were equally interesting. There was nothing forced about that convention, and the proceedings had plenty of kick. Others come to mind that were not nearly so lively. Sometimes a convention seems to be the tail of a machinery-exhibit kite. There are conventions and conventions, but the least effective are those of the Pollyanna variety.

A World Congress on Gold

AMBITION TO SECURE a world gold-mining congress and exhibition for the Rand has seized our Johannesburg contemporary, the *South African Mining and Engineering Journal*. Such an undertaking, it says, would be both timely and beneficial to the Union, where gold mining is the greatest and most stable industry, yielding in 1924 about 60 per cent of the world's production. Johannesburg it suggests as the most suitable place.

To many it would be a pleasure and a valuable opportunity to visit the great gold fields of South Africa. Time and money would be the only obstacles. Johannesburg is a distant point for travelers, whether they come from Canada, the United States, Australia, England, or elsewhere. Only those having abundant leisure could undertake a journey that means weeks upon the water, to say nothing of the expense involved. But they would be well repaid for their trouble. Nowhere have the post-war problems besetting gold miners been more acute than on the Rand. Conferences in which representatives from the world's producing fields might join would help give all a better view of their position. That anything can be done to aid the industry by legislation or other artificial means is by no means clear. Rather it is likely that to himself alone the miner must look for help. The reaction to the proposal will be watched with interest.

Railroads Assist the Miner

THE ESTABLISHMENT has just been announced by the Southern Pacific Railroad Co. of an "Industrial Minerals Service Bureau" to operate under the supervision of its geological department. The "Espe" has a line from Ogden, Utah, to San Francisco, two lines between San Francisco and Los Angeles, and another between Los Angeles and New Orleans. With its branches it traverses a huge territory of great mineral wealth. The prime object of the railroad company, of course, is to foster mining enterprises and by so doing to create traffic. One of the early steps is to send questionnaires to manufacturers to ascertain what their requirements, particularly for non-metallic minerals, may be.

The railroad company is approaching the problem in the right way. Prospectors and claim owners frequently know of deposits that never have been developed because no one realized that they were of value. Nor have prospectors often done systematic searching for non-metal ores, for the reason that they have been unfamiliar with the needs of industry. The new bureau hopes to function as a clearing house between producer and manufacturer for the mutual advantage of both—and consequently of the Southern Pacific.

The Canadian Pacific Railway Co. through its Department of Colonization and Development distributes reliable and condensed information, in the form of circulars, regarding all of the commercially valuable minerals. The following list of subtitles on one of these shows the scope of this service: Description, Sources, Uses, Mining, Manufacture, Production and Price, Exports, Imports, Tariff, Producers, Purchasers. The data are of great assistance not only to Canadians opening new territory but to owners of land who have never investigated mineral possibilities.

Mining Engineers of Note

George H. Dern

Governor of Utah

SELDOM has a greater personal tribute been paid a man than that of the citizens of Utah to George H. Dern, mining engineer, mine manager and metallurgist, when they elected him Governor of their state in November, 1924. Mr. Dern's opponent was the Republican incumbent, who had filled the office with satisfaction and who headed a well-organized machine; unlike Mr. Dern, he was a Mormon, a consideration not without weight in Utah; and the Coolidge landslide — that eventuated — was expected to carry the state Republican ticket into office with a rush. Not even the most ardent Democrats really hoped for success. However, when the votes were counted George Dern was elected with a large plurality. He stood alone; the state offices and the legislature were solidly Republican. When the voters of Utah closed the curtain in their booths and searched their hearts most of them concluded that they wanted George Dern to be Governor. During the campaign he drove his own automobile—he is past fifty, but is as vigorous as most men of thirty—over good roads and bad, making four or five speeches a day, and giving the people a chance to look him over. Not a flowery orator, Mr. Dern is a most engaging speaker—human, logical, clear, convincing. Although by no means a politician in the sense of making officeholding a business, Mr. Dern had served in the state legislature for several terms, and he was well known for the many progressive but sound laws that he had introduced and supported. The people, both of the capitalist and working classes, knew him and voted for him as a pure tribute to his character. George Dern was born and raised on a farm in Nebraska. He played baseball and football at the University of Nebraska and was captain of the team that won the Missouri Valley football championship in 1894. In the following year he went to Mercur, Utah, where he started as bookkeeper for the Mercur Gold Mining & Milling Co., which later became the well-known Consolidated Mercur. He became general manager of the company about 1900, and in 1904 he took over, in addition, the duties of superintendent of mines and mills. Here he made a remarkable record in profitably treating low-grade ores until the mines finally were exhausted; and he never had a labor strike. Mr. Dern with Theodore P. Holt developed the chloridizing roast-leaching process and the Holt-Dern furnace for treating low-grade silver-lead ores. He organized the Tintic Milling Co., which built a plant using the process at Silver City, Utah, and later was consulting metallurgical engineer to the Tintic Standard Mining Co. at the time it built its reduction works at Harold, Utah. He is a director of a number of mining companies and of sundry other industrial enterprises in Utah. He is married and has five children. In an address before the Utah Section of the A. I. M. E. two years ago Mr. Dern, after alluding to the desirability of greater activity in public affairs on the part of engineers, said: "However, if engineers do well in their own profession they may in the end be doing a great public service. We hear a great deal of talk nowadays about who is the progressive and who is the standpatter. As a matter of fact, great progress is not brought about by passing laws, but by scientific discoveries. The real progressive, the real benefactor to humanity, is not he who would curtail profits and discourage capital, but he who increases the world's resources through research into the laws of nature. Not by taking other men's money away from them, but by making available new stores of wealth, is the best way to raise the standard of living of the many. May the mining engineer continue to do his share of this work in the future as he has in the past and receive his share of the glory and the reward."

GEORGE H. DERN

Governor Dern is versatile. He is not quarrelsome; but his opponents as well as his friends know that he can fight. He is diplomatic and tactful in his dealing with men; yet not circuitous. He is a scholar; but he is not an impracticable idealist. The reason that he is now Governor is that so many people who know him agree with a Utahn who says: "He suggests rugged strength—physical, mental, and moral; and he is the *squarest* man I know."

Development of the Rotary Pipe Conveyor

An Accessory to Ore-dressing Plants That Is Applicable Under Many Conditions

By Edward W. Davis
Superintendent, Mines Experiment Station,
University of Minnesota

THE PRACTICE of using a rotating pipe for carrying mixtures of ore and water was introduced into this country from Mexico by J. V. N. Dorr. He used the device in 1909 at his plant at Terry, S. D., for conveying tailings. He found that the carrying capacity of the pipe was small, however, and as far as is known no serious attempt had been made to use this conveying principle in modern plant design prior to 1922.

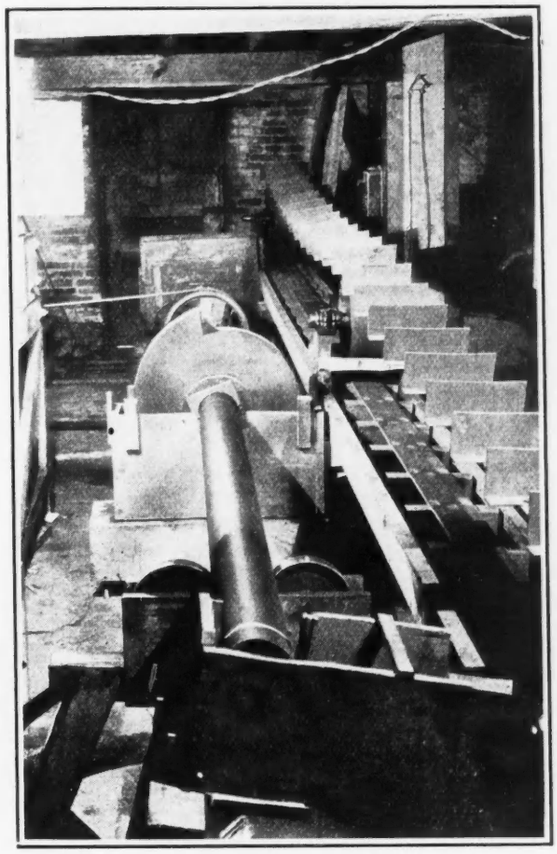


Fig. 1—Experimental pipe launder arranged with scraper conveyor to return pulp

In 1920 some experimental work was started in connection with the pipe launder or conveyor at the Mines Experiment Station of the University of Minnesota. The equipment consisted of a 20-ft. length of 5-in. pipe supported on trunnions and connected by a belt to a driving motor. An ordinary ball-mill scoop was attached to one end of the pipe and a scoop box built around it. It was possible to feed wet ore into the scoop box, from which the scoop picked it up and forced it into the pipe. The rotation of the pipe prevented the ore from settling, and the mixture of ore and water was therefore carried through the pipe and discharged from the open end. To conduct these experiments without using a large quantity of ore, a scraper conveyor was built, and placed so that the pulp discharged from the pipe launder was picked up by the scraper conveyor and conveyed back to the feed box. By this means it was possible to operate the pipe launder for a considerable time without constantly crushing and preparing new material. A photograph of this installation is shown in Fig. 1. When this photograph was taken the launder was equipped with two scoops.

The results of the early tests were not encouraging. The launder carried water and dilute pulp efficiently, but when solids were added to decrease the dilution of the pulp, the carrying capacity fell off rapidly. All of the early tests were made using classifier sands finer than 6 mesh, and with this material at 10 per cent solids the launder had a capacity of 5 cu.ft. per minute; at 70 per cent solids the capacity decreased to 0.3 cu.ft. per minute. Changing the type of scoop used did not have much effect on the carrying capacity, but changing the screen analysis of the ore had a marked effect.

It was found that by increasing the amount of —100-mesh material in the pulp, the capacity of the launder for carrying pulp at 70 per cent solids could be doubled. Observations at the discharge end of the pipe launder immediately indicated the reasons for this increase in carrying capacity. When the sand alone was being fed, the rotary action of the pipe carried the ore upward on the side of the pipe in the direction of rotation. The water, however, drained out of the ore and ran along the bottom of the pipe, carrying little sand with it. When the —100-mesh material was added to the pulp there was much less segregation of the ore and the water and the whole mass of pulp flowed along the bottom of the pipe. Fig 2 shows diagrammatically the effect of adding fine ore to the pulp.

It was apparent that to secure high capacities with the pipe launder it was necessary to prevent the segregation of the ore and water. This was ultimately accomplished by attaching four 1-in. angle irons, spaced at equal intervals, around the inner surface of the 5-in. pipe. These angle irons were straight and ran the full length of the pipe. They operated as lifters or mixers and prevented the segregation of the ore and water. At the same time they did not hinder the free flow of the pulp through the pipe. When these lifters were used, sandy ore at 75 per cent solids was readily conveyed through the pipe. The effect of these lifters was to keep every particle of ore floating, with the result

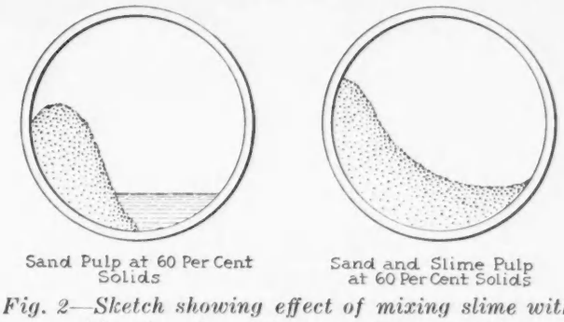


Fig. 2—Sketch showing effect of mixing slime with sand in a launder with a smooth inner surface

that the thick pulp flowed almost as readily as water. When observing the discharge from the rotary pipe launder it is difficult to believe that the pulp is 70 per cent solids, as the fluidity appears to be so high.

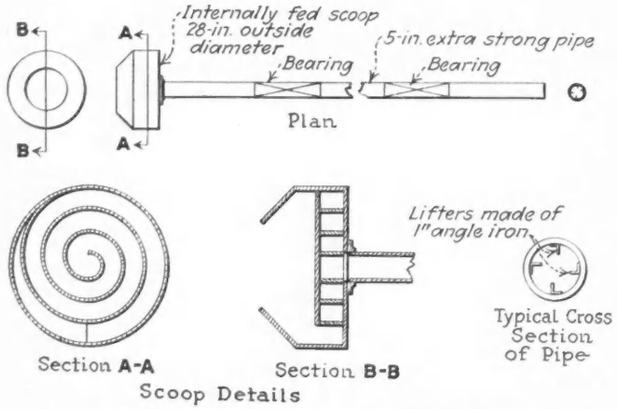


Fig. 3—General drawing of rotary pipe conveyor (patented) and scoop feed, showing the final design of the conveyor and the details of the spiral

The scoop that is used to pick up the ore not only delivers the pulp into the pipe, but furnishes the pressure that causes the pulp to flow through the pipe. During the experiments it was learned that the ordinary ball mill scoop would discharge its pulp against only a very slight pressure. The use of a double or triple scoop did not increase the capacity of the launder, since no greater pressure was produced than with the single scoop. The capacity of the rotating pipe to carry pulp is proportional to the cross-sectional area of the pipe and the pressure at the scoop. Therefore, to increase the carrying capacity of the pipe without increasing its diameter abnormally, it was necessary to design a scoop that had a "pick-up" capacity sufficient to keep the pipe supplied with pulp and that at the same time would develop a pressure sufficient to force this same amount of pulp through the pipe. The ordinary ball-mill scoop has a large "pick-up" capacity, but develops too small a pressure to be used in connection with a pipe launder. In the ordinary ball-mill scoop the spiral usually makes one turn before it connects with the central cylindrical opening.

In the Frenier type of pump the spiral makes ten turns before connection with the cylindrical opening. The ordinary Frenier pump will develop a maximum pressure of about 10 lb.; therefore, to make a scoop suitable for use with the pipe launder it was necessary to add a few turns to the ordinary ball-mill scoop and thus make it more like the Frenier pump. A study of fundamental principles revealed the following facts: (1) A pump of the Frenier type cannot be designed to produce a discharge pressure greater than 14.7 lb. per square inch. (2) This limitation of pressure is due to the fact that doubling the pressure on a given volume of air reduces this volume by one-half or more: generally $P_1V_1 = P_2V_2$. (3) In general the pressure that a spiral scoop will develop is the product of the mean diameter and the number of turns in the spiral. A larger number of turns of a small average diameter or a small number of large diameter may produce the same pressure, but no matter how large the diameter or how great the number of turns the pressure built up cannot exceed 14.7 lb. per square inch. (4) The maximum pressure in pounds developed by any scoop is proportional to the specific gravity of the material pumped. If the scoop develops a static pressure of 5 lb. while pumping water, it will develop a pressure of about 7 lb. while pumping pulp of a specific gravity of 2.

As a result of this study of ball-mill scoops, a method of design was worked out so that scoops could be constructed to meet the requirements of the pipe launder. Tests proved that for ordinary purposes a scoop having

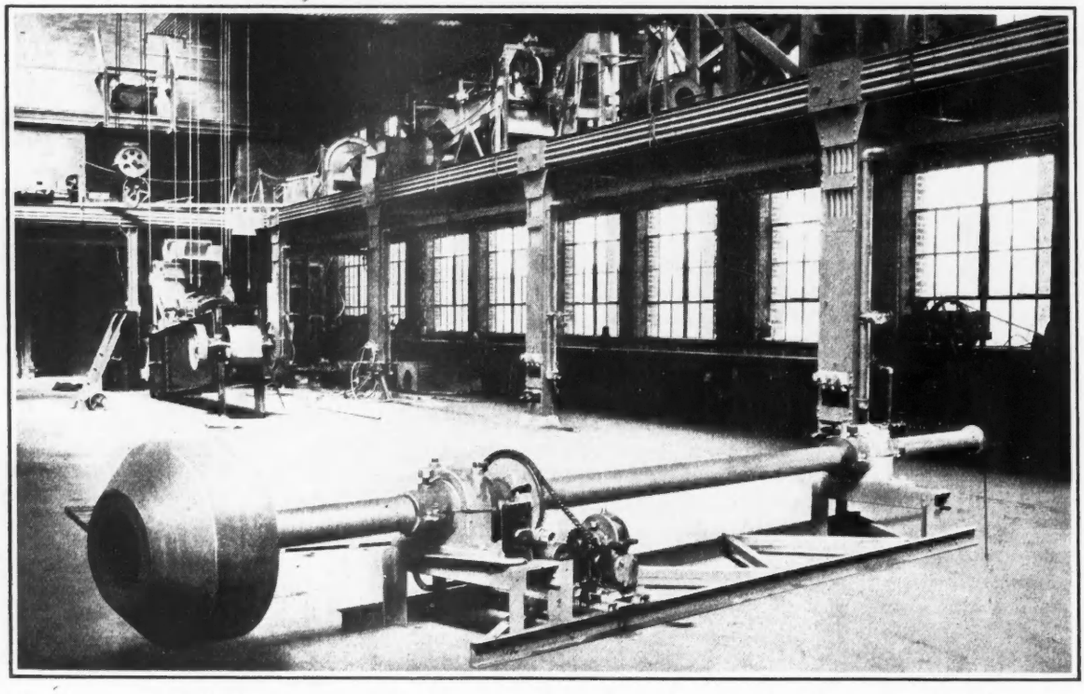


Fig. 4—Assembled pipe conveyor (patented) in the commodious testing theatre at the Minnesota Mines Experiment Station. It is readily portable

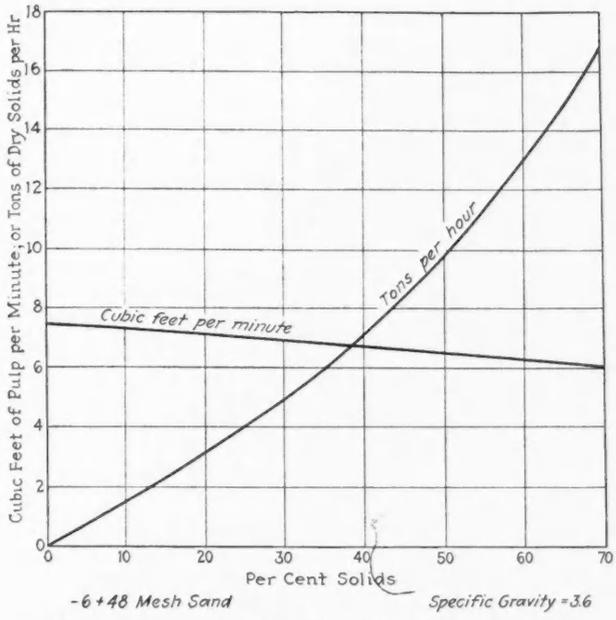


Fig. 5—Curve showing characteristics of a 5-in. rotary pipe launder

2½ full turns of the spiral was sufficient. It is important to keep the number of turns of the spiral down to a minimum, so as to reduce the wearing surface, and also to have sufficient space for large channels through which the pulp can flow without danger of clogging.

When a scoop box is used, which is ordinarily the practice, it is necessary to maintain a wearing shoe on the lip of the scoop, but with the internally fed scoop no wearing shoe is necessary, as the abrasive action of the ore is reduced to a minimum. Experimental work showed that the capacity of the drum type of feed scoop was less than the capacity of the ordinary type in which the feed box is stationary. This is due to the fact that the rotary action of the drum into which the pulp is fed tends to carry the ore around with it. This is especially noticeable when conveying dense pulp, and the drum type of scoop is not to be recommended when maximum capacity and maximum net elevation is desired in connection with the handling of dense pulp.

The characteristics of the 5-in. pipe launder, shown in Figs. 3 and 4, are shown on the curves in Fig. 5. It is apparent that the launder will carry about the same quantity of dense pulp as of water. The nature of the ore makes little difference so long as there is sufficient water to float the particles of ore through the pipe. Whether or not sufficient water is present in any pulp for satisfactory operation of the pipe launder can be determined easily. If violent shaking of a little of the pulp will prevent the ore from settling in a solid mass, the launder will handle this pulp satisfactorily.

By using pipes of large and small diameter in the experimental work, capacity tables were worked out by means of which complete designs of pipe launders can be made to meet any requirement. It was found also that the pulp could be discharged from as many points as desired along the rotating pipe by simply making openings in the side of the pipe. Further experiments showed that it is also possible to place as many scoops as desired at points anywhere along the pipe.

As a result of this investigation several pipe-launder installations have been made in commercial plants. The most extensive installation was that at the iron-ore concentrating plant of the Mesabi Iron Co. at Babbitt, Minn. A part of the fine-grinding flow sheet is illustrated in Fig. 6, which shows that two ball mills were operated in closed circuit with four classifiers. Two pipe launders 20 in. in diameter were necessary, to close the circuit. One was equipped with two scoops and two discharge points, to pick up the sand from the four classifiers and deliver it to the two ball mills. The other launder was equipped with two scoops and four discharge points, to pick up the product of the two ball mills and distribute it between the four classifiers. All of the scoops, including those on the ball mills, were 8 ft. in diameter and 20 in. wide. Special gates were provided at all of the discharge points, so that it was possible to shut down either the ball mill or any of the classifiers without disturbing the rest of the flow sheet. In this plant the crude ore was —4 mesh and the classifier overflow was —48 mesh. The ore was hard, dense magnetite, and the ball mills were operated at 70 per cent solids. This flow sheet has operated satisfactorily when the circulating load through the pipe launders was 350 tons of solids per hour.

The wear on the inside of the launder, including the lifters, is slight. The ore is floating in the water most of the time and does not slide on the pipe. The wear is about the same as that encountered in the discharge trunnions of ball mills, so it is apparent that a pipe launder installation properly made will last for many years. The power required for operation is small, especially if internally fed scoops are used. The scoops are made of cast iron, or, if preferred, can be welded up out of steel plates. Ordinary steel pipes can be used for the launder, but if the installation is for heavy duty, cast iron is best, on account of its rigidity. In many plant flow sheets it is necessary to carry thick pulp through short distances without loss of head. To accomplish this, bucket elevators are commonly used to elevate the pulp to such a height that it will flow by gravity to the desired point. If a net gain in head of not more than three feet is required, and when the distance through which the pulp is to be conveyed is not over 100 ft., the rotary pipe launder is an efficient machine.

The pipe launder or conveyor the development of which has been described here has been patented and is being manufactured by the Dorr Company under the name of the Dorrco rotary pipe conveyor.

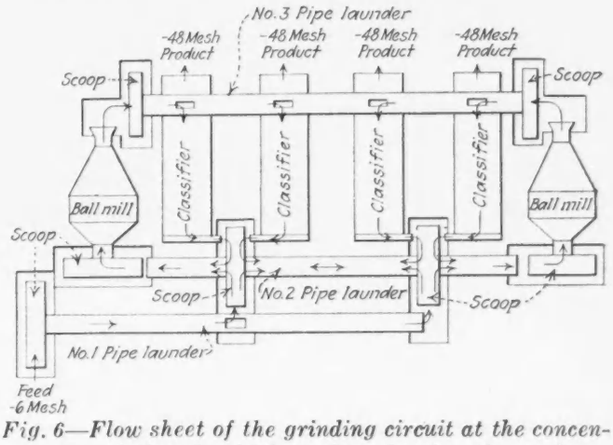


Fig. 6—Flow sheet of the grinding circuit at the concentrator of the Mesabi Iron Co., showing three pipe conveyors

Synopsis of a Theory of Metallogeny*

By Juan Hereza y Ortuño
Engineer of Mines, Huelva, Spain

METALLOGENY, the science which attempts to explain the formation of metalliferous deposits, is in a state of constant development, without yet having actually reached that pre-eminent position which other sciences have attained. The theories developed by Sandberger and other geologists of the German school, which depend upon the derivation of metalliferous deposits through the action of superficial waters on the constituents of eruptive and sedimentary rocks, have already fallen into neglect. This type of processes of oxidation and reduction, besides being complicated, gives no clear idea of that separation which nature has effected in mines which contain chlorides, fluorides, sulphides, and carbonates.

The studies of Fouque and Deville concerning volcanic fumaroles were the beginning of an evolution in those ideas of metallogeny which postulate the active intervention of internal mineralizers and the no less important action of thermal waters as the necessary agents for concentrating, in certain regions, the useful minerals. In volcanic fumaroles geologists have seen,

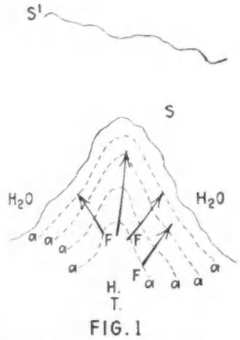


FIG. 1

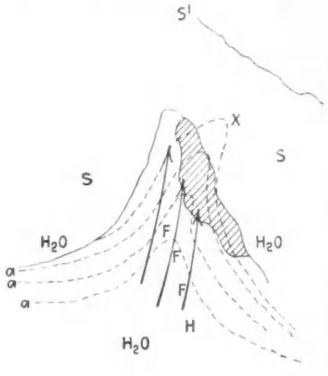


FIG. 2

with profound insight, the same elements that serve as mineralizers for the useful minerals, and these are, as we have already observed, chlorides and fluorides, sulphides, and carbonates. But in this comparison, between volcanic activities and purely endogenous phenomena, many geologists have gone much too far, in extending to great depths the conception of this same composition of external fumaroles. In my judgment—and here is the cardinal feature of my theories—internal fumaroles, expelled by hypogene intrusions, are composed principally of hydrocarbons; and, in addition, accompanying them, other elements of primary mineralizations: chlorides and fluorides, sulphides, and their homologues. The rule in depth, even though there may be present local phenomena of oxidation, is reduction and synthesis; and carbon dioxide originates in the superficial depths through the combustion of hydrocarbon, which becomes, in the deep regions, a veritable protector, preventing the oxidation of the sulphides.

The fissures of fissure veins are weak planes and are adequate for enabling slight oxidizing action to penetrate to the depths, with the surface waters. When this happens, a portion of the hydrocarbon burns, and thus is explained why in great depths, in lead veins, for example, there is found as gangue calcite, siderite, rhodochrosite, etc.; barite may originally form as carbonate, but the great stability of the sulphate causes it to assume this form.

Note that cinnabar, and often silver, in sulphide deposits of this metal, is frequently accompanied by hydrocarbons; as silver and mercury form sulphides which are highly soluble in alkalies, their final deposition sometimes takes place at temperatures so low that these deposits have the appearance of a partial condensation of hydrocarbon. In some instances an incomplete combustion of these hydrocarbons produces deposits of carbon, of graphite, and bituminous substances, as is the case in nearly all deposits of mercury and in the notable argentiferous deposits of Konigsberg and Andreosberg. And not only in mercury and silver deposits is found the trace of the hydrocarbons. In those great classic masses of cupriferous pyrite in the Huelva district in Spain, the sedimentary wall rock is black carbonaceous shale. The other wall rock is formed by a hypogenic intrusion of porphyritic diabase. I believe that this carbonaceous impregnation is due to an incomplete combustion of hydrocarbons in a zone which is easy for oxidation to penetrate, for we find the same carbonaceous trace in the shales which surround most of the massive eruptives, whether or not they contain known mineral deposits. I will not detail the occurrence at Sulphur Bank, in California, since that is well known to American geologists and serves to confirm again the idea already expressed concerning the intimate relation between hydrocarbons and sulphurous formations.

Having briefly stated the outlines of my theory for the explanation of the formation of primary ore deposit, ideas which I am developing at greater length in the *Revista Mineral de Madrid*, I will apply these theories to some specific cases of ore deposits.

Pneumatolytic Metallogenesis—I include in this group, among other forms of mineralization, the phenomenon called magmatic segregation; certain emanations of sulphide, especially of iron and copper; and those resulting from fluoric action, which is shown as having been intense in deposits of tin and the like.

As to the phenomena of magmatic segregation peculiar to magnetite, chromite, and ilmenite deposits, I am not inclined to assign great importance to those activities of liquation and magmatic differentiation in a closed vessel with a predominance of physical agents of the type advanced by Vogt. I believe that all these phenomena are controlled by Van T'Hoff's law relative to osmotic pressures, according to which these pressures vary directly as the absolute temperature. But for this law to have an efficaceous working it is necessary that there be, in the magmas, a mobilizer that will give to the mineral elements the right condition so that they may move rapidly to the zone of least pressures. This mineralizer in ultra-basic rocks is chlorine, in most cases; but nevertheless sulphur also operates and becomes predominant in less basic magmas.

*Original contribution to *Mining Journal-Press*. Translated from the Spanish by J. E. Spurr.

Two cases may occur: *a*. That represented in Fig. 1, in which a hypogenic intrusion makes its way, at great depths, into sedimentary rocks (S), without easy communication with the natural surface of the S terrane. In this case the temperatures and pressures remain in the profound depths of the magma T, in such a manner that one may conceive of isobar surfaces, projected as *a*; and the fumaroles, represented by the arrows F, will take normal routes toward the surface, to achieve decomposition, under the influence of slight oxidation activity, in the periphery of the mass.

b. But the most general case will be that in which, to the normal dominating pressures in the hypogene mass, there may be added the effects of a depression, due to a more or less remote communication with the surface S′, a communication which we designate by the line X. Under such conditions, the isobars, which in every case will be tangential to the eruptive mass at great depths, will establish themselves at the vertex of the same, in a manner similar to that shown in Fig. 2; and the fumaroles (F) will have a preferred region for their decomposition and will deposit according to the following well-known reaction:

(1) $2\ Fe\ Cl_3 + 3H_2O = Fe_2O_3 + 6\ H\ Cl$

As these processes take place before the solidification of the magmas (and that means a temperature of 1,700 to 1,800 deg. C.), the sesquioxide of iron (Fe_2O_3), the stable form under normal conditions, cannot exist under the conditions peculiar to intrusion, since the sesquioxide, at these elevated temperatures, obeys the following reaction:

(2) $3\ Fe_2O_3 + Heat = 2\ Fe_3O_4 + O$ (Greenawalt: "Hydrometallurgy of Copper.")

Therefore the stable form at the high temperature at which magmas solidify is magnetite, the ore which is dominant in depth. When an author supposes that Fe_2O_3 can be precipitated and then reduced to Fe_3O_4, he is talking about ordinary conditions, which do not exist in depth.

Under the hypothesis that eruptive magmas do not contain the dissociated elements of water, this must exist at great depths, and can enter the magmas through lines tangential to the isobars of the eruptive mass, in the form of vapor or dissociated, to cause reactions in the periphery in the form expressed (1), giving the segregation of magnetite (m).

We designate as *estereogenesis* the complex of physico-chemical activities, which determines, for an ore deposit, the place that it occupies in space. In the special case which we have just considered, physical activities predominate, which are due, on one hand, to the displacement of the still fluid magma, which leaves a space for the precipitation of the magnetite; on the other hand, there is a physical contraction of the magma, which, through the fumaroles, loses a quantity of material. Once this purely pneumatolytic process is finished, there comes the simply hydrothermal process, and in the upper regions designated as X, there may be deposited hydrothermal deposits: first of sulphides, and later, when the hydrocarbons burn, of carbonates. The estereogenesis of the first is generally due to the filling of pre-existing fissures, and that of the second to the metasomatosis or replacement of easily soluble rocks, like limestones. As a general rule, in ancient formations, which have been affected by Huronian and Caledonian folding, erosion has obliterated the traces of the sulphate and carbonate deposits. In Hercynian folds, where sulphate ore deposits are the rule, there remain few traces of the carbonate deposits. Nevertheless, in the Huelva district, at a higher horizon than that of the great sulphide masses, there are deposits of manganese carbonates, and silicates; and as there are no limestones in the zones where these masses occur, one must admit for these deposits that they are original carbonates, due to the combustion of the hydrocarbons at horizons relatively close to the surface at that time. Where the great sulphide masses have a great cropping of iron, through alteration of the pyrite, as at Rio Tinto, the manganiferous deposits have been denuded. When the great masses, like that of Zarza and of Perrunal, are without superficial alteration, there are preserved traces of the manganiferous formations. It is logical to conclude that in the horizon where the manganiferous formations are predominant, there must be many sulphide masses still hidden.

In the trachytes of Cape Gatas (Almeria) there are auriferous quartz veins of fluoric pneumatolysis; at higher horizons the filling is of sulphides, galena predominating, with pyrite and blende. Above, and as an outcrop of the lead veins, are iron and manganese, changed into oxides by epigenesis. In such insoluble formations as these, what origin can be attributed to these carbonates if not that which we have shown?

Turning to the pneumatolytic phenomena of the so-called magmatic segregations, we believe that there may be classified in this group the deposits studied by J. F. Kemp in the Adirondack region and many others in Minnesota, Cumberland (Rhode Island), etc.—mixed phenomena.

But these phenomena have not always developed in the manner which we have described—that is to say, producing this special succession, which begins in depth with the chloridic or sulphidic segregation of pneumatolytic character, following with sulphide metallogenesis by the hydrothermal process, and ending, in the natural and logical manner, with the carbonate deposits due to the combustion of hydrocarbons, which I believe are never absent in this class of phenomena. Besides this process of special metallogenesis, there must be cases in which the hypogene intrusion comes to rest close to the surface, and others where it emerges in great volcanic necks; in both cases the magmas come to rest in the zone of oxidation, and these three types of mineralization, which in other cases succeed on another in time and space, take place together, at the same time, in the same region or horizon, with an environment which is at once oxidizing and reducing; the gases and fumaroles escape suddenly and violently, producing in the magmas in process of solidification that amygdaloidal facies which is characterized by fillings of zeolites and other hydrous silicates of metamorphism, accompanied by native metals, especially copper and silver.

This is the metallogenetic facies which occurs in certain porphyritic diabases in Chile; in the amygdoloidal dolerites of Queensland; in the basalts of the Faroe Islands; and above all in the diabases and amygdoloidal melaphyres of the Keweenaw peninsula in the copper-bearing zone of Lake Superior.

I have the profound conviction that all these phenomena, developed in superficial zones (because of the hypogene expansions), are explained with fewer difficulties by the hydrocarbon hypothesis than by any other. The complicated processes imagined by Pum-

pelly, Van Hise, and Rivot, to explain the reduction of metals from the primitive sulphides, must give way to such a simple and logical process as is the agency of hydrocarbons. The abundance of calcite in these deposits is an evidence of those combustions. The native state of the copper and silver is proof of a natural metallurgy, carried to the extreme, which was at once oxidizing and reducing. The amygdules and open fissures in the hypogene masses, as regions of least pressure, have attracted to themselves the gases as fumaroles and have formed these notable deposits. In sum: by the conception of original hydrocarbons, which are always accompaniments of the magmas, there are explained this and other obscure metallogenetic phenomena, if not with absolute clarity (which is not easy in the class of processes), at least with greater likelihood.

Since the burning of the hydrocarbons takes place in regions relatively near the surface, it is natural that this class of deposits remains restricted to the superficial zones. Perhaps from this originates that traditional error which consists in attributing to limestone an active rôle in the general phenomena of carbonation. Limestone, according to my hypothesis, has a mineralizing power rather than that of mineralizer; that is to say, that, on account of its solubility in juvenile waters charged with carbon dioxide, it offers an adequate medium for the phenomena of metasomatism. There will be special cases where the limestone by itself plays an active rôle, producing superficial carbonations, but these very cases of exceptional character confirm the general rule. The usual case will be that in which the metallic bicarbonates, produced by the combustion of the hydrocarbon in residual waters of the sulphuretted hydrothermal type, replace the earthy alkaline carbonates.

To explain the formation of iron deposits by replacement of limestone it is very frequently supposed that they may have originated by the oxidation of masses of sulphides existent in depth; and afterward through the action of these acid waters on limestone there would be formed the great masses of carbonates and oxides of iron. In the first place, the masses of sulphides are formed in a reducing environment and do not arrive at an oxidizing environment until denudation carries them to near the surface. To suppose, for example, that the colossal masses of carbonates at Almeria and Grenada can have originated from masses of sulphide in depth, even though such masses do exist (according to our hypothesis), is to suppose a process inadequate to explain the magnitude and purity of such formations. Secondly, the action of ferric sulphate on an alkaline earthy carbonate yields, as stable form, the ferric oxide, and not the carbonate, which is what we find in the deposits in question, which in the superficial zones have changed to oxide by epigenesis.

$$Fe_2(SO_4)_3 + 3\,CaCO_3 = 3\,CaSO_4 + Fe_2O_3 + 3\,CO_2$$

We must definitely admit, as a process which is rational and possesses the most general characteristics, the combustion of hydrocarbons in zones where there are oxidizing influences and where there still exists a certain temperature which makes ignition possible.

The analysis of gases proceeding from submarine eruptions in Torre del Greco and the Azore Islands, which was made by Fouque and Deville, and in which were found, together with carbon dioxide, great quantities of unburned hydrocarbons; the already cited case of Sulphur Bank; the constant presence of the gas (carbon dioxide) in eruptive centers and in thermal mineral waters connected with Tertiary eruptions, are an inequivocable proof of the superficial combustion of hydrocarbons. On the other hand, the absence or great scarcity of these processes in depth, induces us to suppose that things happen in the manner described: that is to say, that in depth there is no active combustion but a constant presence of hydrocarbon in the fumaroles of the hypogene magmas; but afterward, when the combustion of these same takes place in superficial regions, there occurs the whole series of phenomena which we have examined.

Petroleum—When the hydrocarbons, stable and primitive compounds in the regions of our planet, penetrate through the fissures of the crust to superficial zones, without having encountered a temperature adequate for ignition, they condense in permeable strata, giving origin to the great deposits of petroleum.

I am not unaware that there are hydrocarbon deposits of organic origin; but the great majority, in evident relation to the great dislocations of the crust in the deep regions of eruptive centers, must have that primary origin which we attribute to deposits of colossal proportions—that is to say, an inorganic origin.

How Lithopone Is Made

The process for making lithopone was roughly described as follows by W. R. Wade, formerly manager of the New York Zinc Co., in a talk recently given to students of the Massachusetts Institute of Technology:

The sulphides are roasted and the roaster gases are made into sulphuric acid. The roasted oxides are leached with sulphuric acid, which dissolves the zinc as zinc sulphate, but leaves the lead behind as an insoluble sulphate in the residue. Barytes is burnt with a reducing agent to barium sulphide. The cinder is leached and the barium sulphide goes into the solution. The solution of zinc sulphate is mixed with the solution of barium sulphide and zinc sulphide and barium sulphate are both precipitated. The precipitate is washed and dried, then heated, wet again, dried again, ground, and packed for shipment.

There are certain processes in its manufacture that are not made public. One of the difficulties to be overcome is to prevent the lithophone absorbing sunlight and turning gray when used for paint. One plant visited by the speaker claimed to do this by repeated heating and wetting.

Lagging the Magnetic Pulley

Operators often have considerable trouble because of a loss of power from slipping belts. To overcome this slippage it is necessary to lag the pulley with some material capable of increasing the frictional contact of the pulley. An old piece of rubber belt or canvas is the usual covering. This covering or lagging is held in place by short flat-head screws or rivets. By this means greater loads can be put on the belt and steeper inclines are promoted without slippage on the head or drive pulley. When this head drive pulley is a magnetic pulley for separation, and its operation depends on keeping cool, the problem of lagging without curtailing the pulley operation becomes difficult. This raises the point of what to look for in a magnetic pulley. It should operate continuously without heating up. It should not require mechanical cooling, and it should permit of lagging without the reduction of efficiency.

Pit of Georgia Kaolin Co., near Dry Branch, Ga. Washing plant in distance, at right

Marketing of High-grade Clays

Each Clay Has Its Own Marketing Problems

By Felix Edgar Wormser
Assistant Editor

A LARGE NUMBER OF CLAYS are produced and sold. Among the high-grade kaolins or china clays it is not unusual to find a dealer or producer selling at least twenty-five distinct varieties. One importer in New York handles fifty grades of china clay from the famous Cornwall mines. Domestic grades are also sold in great variety. As a matter of fact, there is no standardization of product; each clay miner produces clays for which he has been able to build up a market, his object being to continue production of his special grades, keeping them as uniform and as satisfactory to consumers as possible. The consumer, on the other hand, grows accustomed to the peculiarities of certain clays and is naturally loath to change. This condition works to the advantage of the clay miner with a good product who has been fortunate enough to find an outlet for that product.

This situation is brought about largely by the fact that the physical characteristics of a clay—the way nature has formed it—are far more important than a chemical analysis of the material. Such qualities as natural color, shrinkage, grittiness, fineness, burning properties, and plasticity affect the use to which a clay may be put. The chemical analysis is a secondary consideration. A clay is not a homogeneous mineral substance but is a complex intimate mixture of several minerals, the most important of which is kaolinite. Generally, the most that is done to any clay in the way of purificiation or refinement is to give it a washing and filtering treatment. No attempt is made at elaborate treatment, for the simple reason that the value of most clays is too low.

High-grade domestic and foreign clays are used principally in paper manufacture, to give the paper body or to furnish a good printing surface or coating. Next in importance is the use of clays in pottery, especially in white-bodied ware, china, semi-porcelain, hard porcelain, sanitary ware, electrical insulators, and kindred articles. Then follows tile manufacturing, and finally the host of miscellaneous uses such as in rubber, linoleum, oilcloth, plaster and kalsomine manufacture, crayons, in pencils' lead, saggers, pigments, and other outlets. The table on page 167 gives detailed amounts of clay used in each consuming branch.

The domestic clay-mining industry was given a great stimulus by the war. American consumers were forced to look to local resources for a supply of clay which had formerly come from England and Germany, owing to decreased shipments from abroad. It was found that American clays were the equal of the imported and furnished a perfect substitute. In some cases American clays succeeded in displacing completely the imported product; in others displacement was only partial, a mixture of foreign and domestic material being used.

American producers have to contend with a prejudice in favor of imported clays. The old troubles with uniformity of American clays have generally passed with the erection here of new up-to-date mining plants and the formation of companies conducting their business on a modern, scientific basis, with a thorough knowledge of clay technology. Some of the American deposits are equal in size to any found anywhere in the world, one of the South Carolina companies owning a tonnage estimated, after drilling, at several million tons of marketable clay.

Clays may be divided into those used in their natural state and those which are burned. To the first class belong paper clays. They are natural clays which have been thoroughly cleaned of grit, are white in color, and disintegrate easily. A slightly "off-color" grade sometimes may be used for paper filling purposes or cardboard manufacture. Some producers arbitrarily classify their output of crude paper clays into two products—No. 1 and No. 2 qualities. The No. 1 grade is the better,

being pure white in color and extremely fine; No. 2 clay is a shade darker. No general specifications are recognized by the trade. The No. 1 grades produced in different localities may have widely varying qualities. The lower grade is worth about $1 per ton less than the higher. The only conclusion that may be drawn is that, for any clay miner, the No. 1 quality is the best crude that *he* produces.

Crude clay is shipped in bulk in box cars or packed in burlap bags containing 100 to 125 lb. each, which are not generally returnable. Powdered clay is usually pulverized to 200 mesh and shipped in paper bags holding 50 lb. each. The clays are sold on sample. Terms of settlement for purchases may permit 1 per cent discount for payment in ten days or net thirty days. Occasionally credit terms are arranged for longer periods. Sales are sometimes made on contract for a year at a time.

High-grade clays used by pottery manufacturers may be residual kaolins, sedimentary clays, ball clays, or slip clays. The term kaolin is generally held by the trade to include any clay that burns white or nearly white, regardless of its origin, and hence includes sedimentary clays. A ball clay is one of good plasticity and bonding power. It is mixed with kaolins to give them qualities in which they are defective, such as plasticity and strength. England was formerly the most important source of ball clays, but large amounts are now procured from districts in Tennessee, Kentucky, and Missouri. The slip clays are easily fusible varieties which are used in glazing pottery and white ware.

The most important property of a clay for pottery manufacture is its burning quality, particularly its color, shrinkage, and porosity after burning. Natural color is a secondary consideration. Occasionally, a clay that may be black or slate gray in color, or have the appearance of burning to anything but a white color, will give an excellent account of itself when fired, yielding a pure white product. Grittiness or silica content of the natural clay used for pottery purposes is not so vital a matter as in paper clays. Certain impurities such as mica may also be permissible in the potters' clay, depending on whether they interfere with the color or physical appearance of the finished product. On the other hand, iron is an objectionable constituent, for it discolors the burned product.

Oilcloth and linoleum manufacturers require a raw, white clay, free from grit, plastic, and opaque. Its ability to absorb the oils used in manufacturing is also important.

The U. S. Geological Survey has defined and classified all types of clays as follows[1]:

Clay is a residual or sedimentary rock which, when finely ground and mixed with water, is plastic (flint clay and kaolin excepted) and retains its molded shape when air dried. When moderately heated (to a dull red heat in many varieties, but the range is considerable) the particles soften enough to partly coalesce and form a stony mass upon cooling. The chemical and mineralogic compositions have a considerable range. The physical properties are correspondingly variable and are equally important. The clay base corresponds closely to kaolinite and similar hydrous aluminum silicates, and material in excess of that required to form these substances is regarded as impurity. The most common impurities are silica, iron, alkaline earths, lime, magnesium, alkalies, carbonaceous matter, titanium, and sulphur.

The uses of clay are many and varied, and new ones are being found constantly. Among the common uses are the following:

[1]Bulletin No. 624, "Useful Minerals of the United States."

In the manufacture of structural and building materials, notably brick and cement, comprising adobe (sundried) brick; common, front, fancy, or ornamental, enameled, and hollow brick; chimney pipe and tops; draintile; fireproofing, including hollow building tile or blocks; flue lining; foundation block; hip rolls and cresting; radial chimney brick and block; silo block; stovepipe thimbles; terra cotta lumber; tile (art, book, ceramic, floor, roofing, and wall); tunnel block; and wall coping.

Domestic products, which enter largely into household use in the form of porcelain, white earthenware, stoneware, and yellow and Rockingham ware for table, cooking, and ornamental use; also sanitary ware, including bath tubs.

Refractory materials, such as firebrick, tile, and blocks, charcoal furnaces, crucibles, muffles, scorifiers, and other assay supplies, furnaces, glass-house pots, stove lining, retorts and condensers, saggers, and tuyères.

Unburned clay is used in making artificial teeth, crayons, and emery wheels; as a filler for paint, rubber, and other materials; as fire mortar; as a food adulterant; in fulling cloth; in lead pencils; medicines; for modeling and molding; packing for horses' feet; in the manufacture of paper (wall, writing, and other varieties); in plaster; in scouring soap; in taxidermy; and in the manufacture of ultramarine.

Other uses include acid brick; aquarium ornaments; art and chemical pottery; battery cups; ceramic sculpture; condensing worms; curbing; doorknobs; flemish ware; garden and lawn pieces; grate tile; lead pots; porcelain electric and hardware supplies; porous cups; pumps; razor hones; shuttle eyes and thread guides; pipes; toy marbles; umbrella stands; and sanitary ware.

Clay occurs in every state in the Union.

The following classification of the U. S. Geological Survey is useful:

High-grade clays:
- White-ware clays (non-plastic and plastic):
  - Kaolin, porcelain, or china clay.
  - Ball clay.
  - Paper clay.
- Refractory or fireclays:
  - Glass-pot clay.
  - Flint clay.
  - Plastic fireclay and shales.
  - Graphite fireclay.
- Pottery or stoneware clays.
- Medicinal clay, bentonite, Denver mud.

Low-grade clays:
- Vitrifying clays and shales:
  - Terra cotta clays and shales.
  - Sewer-pipe clay and shale.
  - Roofing-tile clay and shale.
- Brick clays and shales:
  - Loess clay.
  - Glacial clay.
  - Pressed-brick clay and shale.
  - Paving-brick clay and shale.
  - Adobe clay.
- Gumbo.
- Slip clays.
- Fuller's earth.

High-grade Clays

White-Ware Clays

Kaolin or China Clay (Non-plastic)—Kaolins are residual white-burning clays, consisting chiefly of the hydrous aluminum silicates and generally possessing little or no plasticity. White-ware clays are used for porcelain, china, white ware, pottery, high-grade tile, and paper manufacture.

Kaolin or China Clay (Plastic)—A sedimentary, generally white clay containing a high percentage of kaolinite and little or no iron oxide. Its principal uses are in the manufacture of paper, sanitary ware, and tile. The plastic kaolins are sometimes referred to as china and ball clays and contain more fluxing impurities than the non-plastic kaolins. They are also often called paper clays.

Ball Clays—White-burning plastic clays of high tensile strength and bonding power and little or no iron oxide. They are extensively used as an ingredient of high-grade

tile and white-ware mixtures to give the body sufficient plasticity and bonding power.

Paper Clay—A highly plastic white clay, free from sand.

Refractory Clays

Fireclays—Refractory or fireclays are clays which endure high temperature without change other than dehydration, but the term is frequently misapplied. Many of the best fireclays are non-plastic, this property being supplied by the addition of a small quantity of less refractory but plastic material. Comparative freedom from fluxes, such as iron, alkaline earths, alkalies, and excessive silica, is essential. The composition, both chemical and mineralogic, is similar to that of ball clay. The principal uses of refractory clays are for materials required in the industries (especially in iron and steel manufacture and in coke making) where high temperatures must be withstood.

Glass-pot Clay.—A variety of refractory clay which, besides possessing refractory qualities, burns dense at a low temperature without warping and has good bonding power.

Flint Clay—A non-plastic, hard, dense, refractory clay, having an appearance much like flint, a shell-like fracture, and a composition like plastic fireclay.

Plastic Fireclays and Shales—Refractory clays and shales which are plastic when wet.

Graphitic Fireclay—A black clay resembling soft coal. It contains about 60 per cent silica and 30 per cent iron and aluminum, and burns buff or white. It is used for the manufacture of pressed brick and converter lining and binding. It seems to be a product of the disintegration of graphite schist or slate.

Pottery Clays

The general term pottery clays includes some refractory and vitrifying clays. These clays are as a rule semi-refractory and burn to a dense mass. High plasticity, tensile strength, and complete retention of form while burning are essential properties. A buff color may be produced, owing to the content of iron or manganese. In ordinary practice a mixture of clays is used. Some of the products are earthen and common stone ware (both plain and decorated), crockery, and glazed ware.

Medicinal Clay

Bentonite, Denver Mud—A bedded or sedimentary plastic clay which swells immensely on wetting. Mixed with glycerine it forms a proprietary medicament known as antiphlogistine. It is used in medicine and as packing for horses' hoofs; also for paper filling and sizing.

Low-grade Clays

Vitrifying Clays

Vitrifying clays are similar to pottery clays, but are composed of lower-grade material. They may be semi-refractory, should burn dense, and should contain considerable iron, both for color and flux. Fair tensile strength is desirable, as is also low fire shrinkage and low vitrification temperature, with a good range in temperature between incipient and complete fusion.

Terra-cotta Clays and Shales—For terra-cotta ware a semi-refractory clay of good grade is preferred. When burnt, low shrinkage and freedon from soluble salts and warping are essential.

Pipe Clays—Almost any fine-grained clay that has a well-developed plasticity and a high percentage of iron, which apparently favors the formation of the necessary glaze, is suitable for pipe clay.

Roofing Tile and Fireproofing requires semi-refractory clay or shale, with fair plasticity and tensile strength, which burns hard at a low temperature. Other uses are for enameled brick, hollow tile, and conduits.

Paving Brick—Material for paving brick includes many impure shales as well as semi-refractory clays. It should possess fair plasticity and good tensile strength.

Brick Clays

Almost any kind of clay which possesses plasticity can be used for common brick. Red-burning clays are preferable, as they harden at a low temperature. Loess, glacial, and marine clays are also used for this purpose. Brick and draintile are the principal products.

Loess (Clays)—The term loess is applied to extensive, uniformly fine-grained deposits which are high in silica, low in alumina, and high in alkalies. Their use is confined to common brick and other cheap products. They are of Pleistocene age and are commonly thought to consist of wind-deposited dust. In the Mississippi Valley they are commonly known as bluff deposit.

Glacial clays are local deposits of generally tough, dense, gritty clays formed directly by the continental glacier or waters issuing from it into flood plains and lakes in the glaciated area of the northern United States. Those formed directly by the ice, as a rule contain many stones. Some of the glacial clays, as in the State of Michigan, are used extensively in the manufacture of cement and pottery, as well as brick.

Pressed Brick—A fairly good quality of clay or shale is required for pressed brick. The shrinkage in air and fire must be low and the temperature of vitrification moderately low. For light-colored brick a semi-refractory clay is used.

Adobe Clays—Adobe clays are surface clays which are high in lime, and hence can be used for but few products, the chief of which is adobe or sundried brick.

Gumbo Clays

The term gumbo clays is applied to fine-grained, plastic, tenacious surface clays of recent formations. Their occurrence along stream channels in the western Central States suggests a relation to loess. The burned product is used largely for railroad ballast, but in some places also for brick.

Slip Clays

Slip clays are used for glazing. They possess the properties of fineness of grain, high percentage of fluxing impurities, and low shrinkage in air, low temperature of fusion, and early maturity in burning. Their use on different clays calls for a wide range in physical properties. Color is of secondary importance, as it is more or less under control.

Most of the domestic clay used in the United States is produced from pits east of the Mississippi River, except the Poplar Bluff, Missouri, district, and in the southeastern part of the country. The northeastern states are situated in a glaciated area, which accounts for the scarcity of clay deposits in that section. As paper manufacturing centers in the northeastern part of the United States, the general run of clay mines is not situated to best advantage. The principal producing states are Georgia, Florida, North and South Carolina, Virginia, Delaware, Pennsylvania, and Maryland. Purchasers of kaolins may draw from several states for their raw material requirements. The principal paper consumers are situated in the manufacturing centers of New England, Pennsylvania, Ohio and Michigan, and the pottery centers in New Jersey and Ohio.

Domestic Clays Used in Many Industries

The U. S. Geological Survey has made a study of the clay deposits of the eastern United States[2], from which the following notations have been taken: North Carolina kaolins are used in making china, semi-porcelain, tiles, spark plugs, and other articles. They are mainly used for the body of white wares and may constitute 2½ to 15 per cent of the mixture. It is said that although some kaolins from North Carolina give satisfaction to potters, they are generally used sparingly. Troubles arise chiefly from shrinkage and plasticity.

Clays from central Pennsylvania are shipped to steel works, plaster plants, and sagger manufacturers.

Virginia clays find employment as fillers in paper and paint manufacturing. Some of the country's best clays come from Virginia. Missouri also produces excellent pottery clays.

Sedimentary clays of South Carolina are chiefly used in paper manufacturing and wall-paper coating. Common impurities are quartz, feldspar, mica, and pyrite.

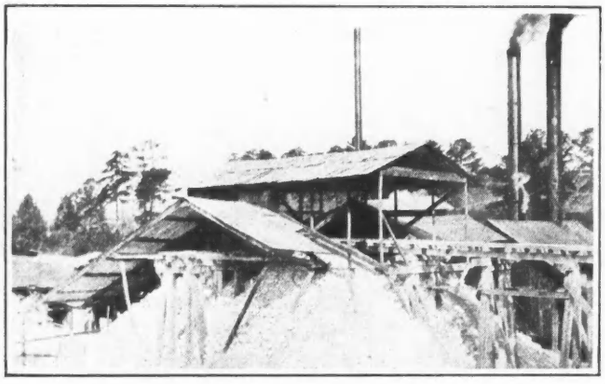
[2]Bulletin No. 708, "High Grade Clays of the Eastern United States."

They are found with slight tints, cream and yellow, and are used to some extent in making paints. The cream-colored varieties are used as textile and paper fillers, colored tiles, rubber goods, oilcloth, patent roofing materials, and for refractories. White varieties are used as fillers in magazine paper, wall paper, kalsomine, white ware, semi-porcelains, and floor tiling.

New Jersey clays are used in the manufacture of pencil leads, graphite crucibles, saggers, and slabs. Kentucky clays are used as ball clays in white ware and high-voltage insulators, saggers, and glass refractories. The white clay of Florida is extensively used in the manufacture of white ware, electrical porcelain, floor and wall tile. It is not usually regarded as a paper clay. It is also used in manufacturing porcelain, fine optical glass, and glass pots. Tennessee clays have many uses. The ball clays and bond clays are used in mixtures for making table, toilet and sanitary ware, electrical porcelain, art pottery, smoking pipes, abrasive wheels, and enamels. All the clay is shipped crude.

Most Georgia clays are washed before shipment. They are used mainly as paper fillers, and also as fillers in shade cloths. Pottery and tile manufacturers use small percentages for their varied output.

Four years ago large deposits of secondary residual



Washing plant of Georgia Kaolin Co., near Dry Branch, Ga.

clays were discovered near Poplar Bluff, Mo. These clays are a cross between a china and a ball clay. They are as plastic and strong as the average ball clay, but have a fired color nearly as white as china clay. Missouri clay is being used extensively in the manufacture of dinner ware, wall tile, electrical porcelain, and sanitary ware.

The impurities found in clays are generally derivatives of the parent rock from which the clay was formed. Common impurities are quartz, iron oxide, lime, mica, feldspar, tourmaline, carbonaceous matter, and garnet. Many of them may be eliminated by careful washing and treatment. They are not necessarily all harmful. The use to which the clay is to be put determines the allowable percentage of impurities. An iron stain may make a clay worthless for white-ware manufacture and yet give it a desirable tint for paint manufacture.

The prospective producer of clay should look carefully to the physical characteristics of his product. He should subject it to tests to determine its plasticity, air shrinkage, color, fineness (grittiness), and its behavior under burning at various temperatures—especially its shrinkage and color after burning. Armed with this information he can tell to what use his clay may be put.

Placing a new clay on the market is not an easy matter. The producer has the alternative of dealing through a broker familiar with the consuming channels and customs, he may endeavor to sell his property to an established clay mining company, or he may try to market the clay himself. It is difficult for one clay to displace another. Consumers, especially paper makers and pottery manufacturers, through long association with clays from certain localities, domestic or foreign, are reluctant to make any change in their practice. They become so familiar with the peculiarities of the raw materials they use that they do not deem it advisable to cast aside this familiarity in favor of working with a new material. Experimentation with other clays may be costly. Should a batch of white ware prove defective using a new clay, there is no salvage. Paper manufacturers are in the same category. They cannot afford to run the risk of producing a paper with inferior printing qualities or a poor color. Almost imperceptible differences in clays may do that very thing.

Competition from Europe

As stated before, domestic clays have strong competition from English china clays. In some cases they have been able to displace the imported grades, but generally only partially. The difference in delivered prices between imported and domestic material is not very great, and to New York and New England users English clay can be delivered at a lower transportation cost from the mines in Cornwall than from the mines in South Carolina, Georgia, Virginia, and other Southern states. English deposits are extensive and have been worked longer than most of those in the United States.

Production and prices have been usually in control of a syndicate, which decides in general what policies the industry is to follow and regulates prices. Shipments are made to the United States usually in bulk in the hold of a ship. On arrival at the ports of entry—New York, Boston, and Philadelphia are the most important—the clay may be lightered and transferred to railroad box-cars for shipment to destination, or it may be stored in warehouses. The English clays are sometimes shipped in casks weighing 1,200 lb. gross. They are sold mainly to paper manufacturers.

The chief competition which both domestic and imported china clays for paper purposes have to meet comes from talc producers, for talc is also used as a paper filler.

Transportation costs are an important element in the delivered cost of clays, both foreign and domestic. The value of the material at the mines is low.

The tariff on imported clay under the act of 1922 is $2.50 per ton on kaolin, china, and paper clay. Other clays not specially provided for: crude, $1 per ton; washed or manufactured, $2; common blue and Gross almerode glass-pot clay, unwrought, $1; wrought, $2 per ton.

Bentonite

Bentonite is a mineralogical term applied to a clay having an alkaline oxide and alkaline earth content of from 5 to 10 per cent and which is extremely fine grained with high colloidal properties. Its color varies widely from a pure white to a yellowish green, pink, gray, cream or brown. When moistened, bentonite swells and will absorb about three times its weight of water. It then becomes exceedingly soapy in appearance and to the touch; in fact, it has been used in soap manufacture. Bentonite is fusible at relatively low temperatures, and in that respect differs from other clays. As with

all clays, the physical properties of bentonite are more important than chemical analysis. No large market has yet been developed for the mineral, but experiments are being made with a view to introducing bentonite into wider industrial application. Prospective producers should carefully determine the peculiarities of their product before trying to market it, as all bentonites do not have similar characteristics.

The mineral is found extensively in the West, especially in Wyoming and South Dakota, and in California. Frequently, it is given some particular trade designation such as ardmorite or wilkinite. The best-known deposits occur in Ardmore and Belle Fourche, S. D., in the Laramie and Big Horn basins of Wyoming; in San Bernardino County, Calif., and in Idaho. It also occurs in Montana, Arizona, Utah, New Mexico, Texas, and Tennessee.

Bentonite has been successfully used for many pur-

Clay Sold in the United States in 1922, by Uses and Kinds *(a)*

In Short Tons

Use	Kaolin, China Clay, and Paper Clay	Ball Clay	Slip Clay	Fireclay (Including Fireclay Dust)	Stoneware Clay	Miscellaneous Clay	Total
White-bodied ware made from white-burning clays, including china, general ware, chemical porcelain, porcelain electrical supplies, sanitary ware and similar uses	52,047	32,285	.....	14,925	.....	.....	99,257
Art pottery	531	877	.....	904	600	381	3,293
High-grade tile	19,534	18,338	.....	10,114	.....	250	48,236
Chemical stoneware	.....	.....	.....	798	2,423	.....	3,221
Stoneware	412	736	.....	558	78,069	80	79,855
Enameling, as coating for granite and other ware	120	900	110	955	.....	.....	2,085
Paper filler	104,403	.....	.....	1,206	.....	.....	105,609
Paper coating	10,243	.....	.....	963	.....	.....	10,243
Rubber	13,779	.....	.....	.....	.....	.....	14,742
Oilcloth or linoleum	8,008	.....	.....	.....	.....	.....	8,008
Paint filler or extender	14,457	.....	.....	692	.....	774	15,923
Paint pigment	280	.....	.....	.....	.....	78	358
Architectural terra cotta	101	2,822	.....	57,237	1,400	17,963	79,523
Asbestos products	267	400	.....	10,860	.....	3,604	15,131
Plaster and plaster products	4,038	.....	.....	6,165	.....	2,357	12,560
Slip for glazing purposes	.....	.....	1,585	.....	.....	.....	1,585
Kalsomine	2,824	.....	.....	46	.....	.....	2,870
Artificial abrasives	10	160	2,355	984	.....	.....	3,509
Crayons (for tailors' use)	505	.....	.....	.....	.....	.....	505
Chemicals	1,093	.....	.....	.....	.....	5	1,098
Pencil leads (graphite)	50	.....	.....	.....	.....	.....	50
Saggers	6,752	14,335	.....	93,900	1,689	7,767	124,443
Pins, stilts, and spurs for potters' use	281	264	.....	1,998	.....	.....	2,543
Wads	.....	1,214	.....	24,828	.....	.....	26,042
Gas retorts	.....	.....	.....	617	429	.....	1,046
Firebrick and block	2,362	248	.....	512,792	358	.....	515,760
Fireclay mortar, including clay processed for laying firebrick	.....	.....	.....	314,586	.....	.....	314,586
Bauxite and high alumina brick	.....	.....	.....	3,943	.....	.....	3,943
Glass-house pots	210	536	.....	15,520	.....	234	16,500
Glass-house supplies, blocks and tiles	90	.....	.....	19,625	.....	.....	19,715
Zinc retorts	.....	.....	.....	19,175	.....	.....	19,175
Zinc condensers	.....	.....	.....	15,646	.....	.....	15,646
Clay crucibles	231	.....	.....	987	.....	.....	1,218
Foundry use and steel works for cupola lining	538	.....	.....	340,981	100	43,568	385,187
Unspecified *(b)*	32,509	3,677	.....	208,215	1,798	448,036	694,235
	275,675	76,792	4,050	1,679,220	86,866	525,097	2,647,700

(a) U. S. Geological Survey.
(b) Includes clay for brick, cement, clarifying oils, gas-stove backs, hollow ware, ink, matches, modeling, peanut coating, phonograph records, red earthenware, refractory cement, roofing tile, sewer pipe, soap, stove lining, stove polish, tanning, and wall paper.

Clay Imported and Entered for Consumption in the United States, 1913-1923 *(a)*

Year	Kaolin or China Clay: Short Tons	Value	Average Price	Common Blue and Gross Almerode Glasspot Clay: Short Tons	Value	All Other Clays, Unwrought: Short Tons	Value	All Other Clays, Wrought: Short Tons	Value	Total: Short Tons	Value
1913	268,666	$1,623,993	$6.04	24,986	$204,911	42,582	$155,693	1,889	$22,178	338,123	$2,006,775
1914	328,038	1,927,425	5.88	16,761	122,325	50,069	195,956	3,232	41,712	398,100	2,287,418
1915	209,132	1,152,778	5.51	8,864	62,569	23,718	90,367	1,343	12,433	243,057	1,318,147
1916	253,707	1,326,684	5.23	2,501	12,134	42,478	163,421	180	1,994	298,866	1,504,233
1917	241,029	1,315,769	5.46	88	709	26,581	123,439	338	2,142	268,036	1,442,059
1918	168,100	1,153,240	6.86	114	983	26,984	163,484	137	1,077	195,335	1,318,794
1919	180,592	1,965,393	10.88	4	133	23,759	187,550	498	4,262	204,853	2,157,338
1920	361,800	3,568,677	9.86	6,837	157,201	34,352	272,524	691	10,267	403,580	4,008,669
1921	162,906	1,546,285	9.49	4,468	77,217	41,421	348,870	120	2,313	208,915	1,974,685
1922	310,136	2,963,420	9.56	7,323	84,415	30,643	246,807	2,468	27,233	350,570	3,321,875
1923	311,298	3,046,191	9.79	12,999	121,272	65,379	481,614	1,676	21,892	391,352	3,670,969

(a) U. S. Geological Survey.

Domestic Clay Sold in the United States, 1913-1923, by Kinds

Year	Kaolin, China Clay, and Paper Clay: Short Tons	Value	Ball Clay: Short Tons	Value	Slip Clay: Short Tons	Value	Fireclay: Short Tons	Value
1913	155,211	$803,434	67,134	$237,672	10,902	$24,505	1,820,379	$2,592,591
1914	150,519	843,151	67,927	255,667	8,237	17,731	1,409,467	2,147,277
1915	141,064	781,142	75,348	301,910	7,646	18,774	1,570,481	2,361,482
1916	201,157	1,075,730	89,761	391,052	14,064	47,939	2,057,814	3,708,009
1917	206,334	1,263,799	107,406	569,240	16,972	70,505	2,347,972	5,625,095
1918	179,694	1,459,529	89,896	590,631	13,552	49,898	2,305,033	5,664,064
1919	152,828	1,475,681	65,026	520,849	5,149	17,556	1,755,331	4,628,605
1920	268,203	2,865,407	69,477	584,611	9,006	41,519	(a) 2,261,915	(a) 7,088,049
1921	162,726	1,579,163	54,014	354,565	4,608	14,841	1,195,861	3,560,373
1922	275,675	2,346,095	76,792	440,877	4,050	19,405	1,679,220	4,633,486
1923	336,803	2,926,255	97,068	620,978	8,420	42,559	2,298,163	6,565,896

Year	Stoneware Clay: Short Tons	Value	Brick Clay: Short Tons	Value	Miscellaneous Clay: Short Tons	Value	Total: Short Tons	Value
1913	153,353	$143,587	158,890	$137,976	282,120	$240,6	2,647,989	$4,180,459
1914	130,383	116,610	199,154	161,852	244,173	214,189	2,209,860	3,756,568
1915	134,297	126,429	101,968	93,863	332,150	288,341	2,362,954	3,971,941
1916	135,958	137,779	97,164	76,854	336,672	314,311	2,932,590	5,751,774
1917	81,352	113,839	93,779	94,703	260,029	305,365	3,113,844	8,042,546
1918	86,800	147,098	(b)	(b)	301,386	421,421	2,976,361	8,332,641
1919	60,236	80,367	(b)	(b)	236,530	367,573	2,275,100	7,090,631
1920	106,350	229,221	(b)	(b)	322,100	467,856	(a) 3,037,051	(a) 11,276,663
1921	86,574	184,540	(b)	(b)	(a) 242,963	(a) 361,818	(a) 1,746,746	(a) 6,055,300
1922	86,866	164,870	(b)	(b)	525,097	725,781	2,647,700	8,330,514
1923	81,389	194,358	(b)	(b)	612,717	837,814	3,434,560	11,187,863

(a) Revised figures. *(b)* Included under "Miscellaneous Clay."

poses, chief among them being: the de-inking of newsprint, the filling of paper and soap, as a medicinal preparation (antiphlogistine or Denver mud), as a substitute for fuller's earth, in refining crude petroleum; as a retarder for gypsum plasters, a filler in pastes and inks, and a dressing for leather. In the manufacture of soap, some bentonite can displace over one-quarter of the fats used without detriment to the quality of the finished product. In some of the uses listed above bentonite must compete with other non-metallic minerals, especially paper makers' clay and talc. As most of the commercial deposits are situated in the West, the cost of transportation of the bentonite to the East is an important factor in the marketing of the mineral.

A large part of the bentonite used today is utilized locally, the California production in Los Angeles, the South Dakota and Wyoming output in Chicago and Denver. Although it may be shipped crude, as mined from open cuts, consumers generally prefer the material cleaned and ground to 100 to 200 mesh.

Prices are a matter of individual negotiation and depend largely upon the physical character of the bentonite and its location with respect to a market. Occasionally the price established depends upon the use to which the bentonite is to be put and the competition it has to meet from other directions. Thus, a Western bentonite going into the manufacture of a "beauty" clay may be sold for $5 per ton more than bentonite for paper manufacture, although the mineral destined to be used as a cosmetic was precisely the same product.

The Department of Mines of Canada has experimented with the use of bentonite and asphalt mixtures to water-proof various substances such as felt, cloth, and paper, and finds it to be a satisfactory material for the purpose. In paper manufacture the bentonite may be used with other clays, and it has been found to increase the retention of the clay by the paper. The color of the bentonite is a most important characteristic when it is used in paper.

A Radium Deposit Near Chihuahua

By M. Perogordo y Lasso
Mining Inspector, Department of Mines, Mexico City

RADIUM, uranium and vanadium ores have been found in several districts of Mexico, principally in the Placer de Guadalupe, in the district of Iturbide in the State of Chihuahua. The placer is 72 miles northeast of the city of Chihuahua. Five miles east is the town of San Sostenes, on the Kansas City, Mexico & Oriente railway, now not in operation owing to the political disturbances. The only way to reach the mines at present is by horse or automobile. The veins of this region were found in 1869 by the Oaxacas, a tribe of natives who were gold seekers (gambuzinos), living in Guadalupe; who passed the deposits every day as they went to their work at the San Diego and Chorreras placer mines. The Oaxacas denounced several claims, and for forty years kept them; but in 1909 they sold their rights to the Cia. Minera de la Virgen.

The real discoverer of the radium ores was Carlos Perez, who, when a young man, had worked in his father's mines. In 1909, Mr. Perez was the superintendent of a mine worked by the Cia. Minera de la Virgen. In a shaft, 30 ft. deep, sulphide ores were found, and, in panning, Mr. Perez obtained a bluish-black residue, which had evidently come from black, radial spots in the ore. At first he thought that it was magnetic iron, but the magnet had no effect on the black powder. He could not melt it, and after all his tests, he thought that it was platinum. After much study, Mr. Perez found that the ore was pitchblende or uraninite, and at once suspected the presence of radium. Several tests with sensitized plates gave him the proof. He sent a sample of the ore to New York, and received a report that the ore was a radioactive pitchblende.

With this knowledge, Mr. Perez acquired several claims protecting the main veins, and since 1910 he has been trying to develop the mines, but with much difficulty, because of lack of funds. The rocks of the district are sedimentary; gray and white limestones and marls, in sheet form and amorphous. Later, dynamic movements and the emission of porphyritic granites caused folding and fractures, and the veins were filled with quartz, a calcite and pyrite from the ore-supplying magmas. Small radial masses of pitchblende and native gold have been segregated in the veins, and they form isolated rich spots.

At the contact zone, between the porphyry and limestone, and in the porphyry itself, there are mineralized fissures, from 1 in. to 15 ft. wide. In the fissure and contact veins, especially at the juncture of the veins coming out of the igneous rock, gold nuggets have been found weighing as much as a pound. The country rock is not altered at the sulphide zone, and the pitchblende nodules appear with native threaded gold. Quartz and yellow calcite, stained with iron, form the gangue.

Erosion has washed the gold from the outcroppings to the beds of the rivers and streams, forming high-grade placers, which were remarkably rich in former times. Gold deposits are scattered in all directions over an area of 70,000 acres.

Several tests have been made at the Geological Institute and in the Industrial Department of the Secretary of Industry, Commerce and Labor of Mexico, and also by Carlos Perez and myself. At the Industrial Department, a small quantity of the radioactive mineral was placed in a glass flask containing some bacteria such as granulo-bacter used in biological fibrous disintegration, and some other pathogenic germs. After a period of forty-eight hours the granulo-bacter was found to have been killed, but the other germs continued to develop.

I have made several tests on sensitized plates, and the impressions were remarkably fine. Tests made with an electroscope demonstrated the high radioactivity of the mineral.

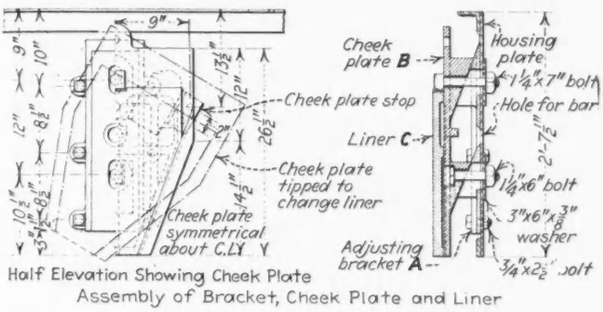
At present, the Placer de Guadalupe radioactive ore deposits are the most important in Mexico, owing to the abundance of the ore and its high value, notwithstanding the lack of development, which extends only through the shallow oxidized zone—30 ft. deep—and a very small portion of the sulphide zone. When further facts as to tonnage and radium content of the ore have been made available it will be possible to form a better idea as to the relative importance of these deposits. As it is, they are promising.

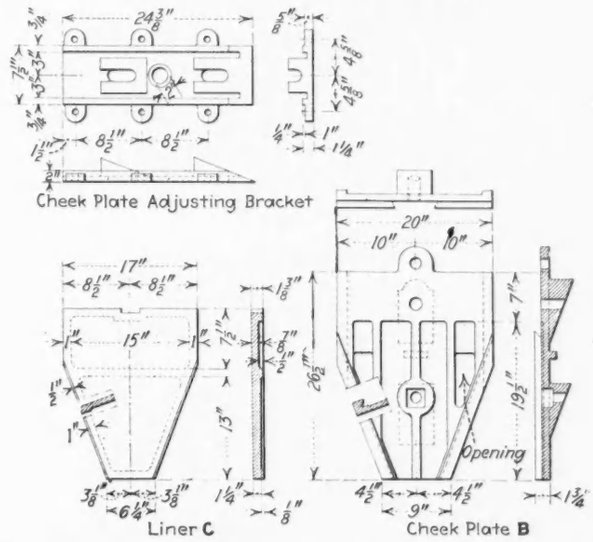
Useful Operating Ideas

Adjustable Cheek Plates for Rolls

By W. J. Tait

The cheek plate shown in the accompanying drawing was designed for a renewable liner and to provide a simple means of adjustment to position without resorting to expensive machined parts. The adjustment is made by raising or lowering the cheek plate, which





Details of cheek plate, liner, and bracket; also showing the three parts assembled

rests on opposing wedges on the back of the plate itself, and on the bracket attached to the roll housing. A hole in the bracket and a lug on the back of the plate permit the use of a bar for making this adjustment. As the feed box prevents the removal of the liners when in a vertical position, the cheek plate can be tipped forward after the removal of the top bolt, and the liner replaced while the plate is in this position. The top bolt also holds the liner in place. In an earlier design this feature was omitted and trouble arose from the liners climbing out of their seats, due to the vibration of the rolls and the trapping of ore particles under the liners. The face of the cheek plate is machined to make a more secure holding for the liner. Other than this no further machining is necessary.

Excess Air and the Extra Cost of Fuel

By W. F. Schaphorst

To emphasize the waste of fuel involved in using excess air for combustion, I have developed a simple chart, reproduced herewith. Merely zigzag across this three times, as shown by the dotted lines, from left to right, and the unnecessary expense per year is found in Column *G*.

For example, if a fuel has a thermal value of 10,000 B.t.u. per pound, and if the excess air traveling through the chimney per hour is 1,000 lb., draw a straight line from the 10,000 in Column *A* and through the 1,000 in Column *B*, and mark the intersection in Column *C*. Then from that intersection run through the difference, in Column *D*, between the chimney-gas temperature and the temperature of the air on entering the furnace, which in this problem I have assumed is 500 deg. F. Continue this line to Column *E*. From the point of intersection, draw a straight line through the "cost of fuel per ton" in Column *F*, and the intersection in Column *G* will give the extra expense involved per year

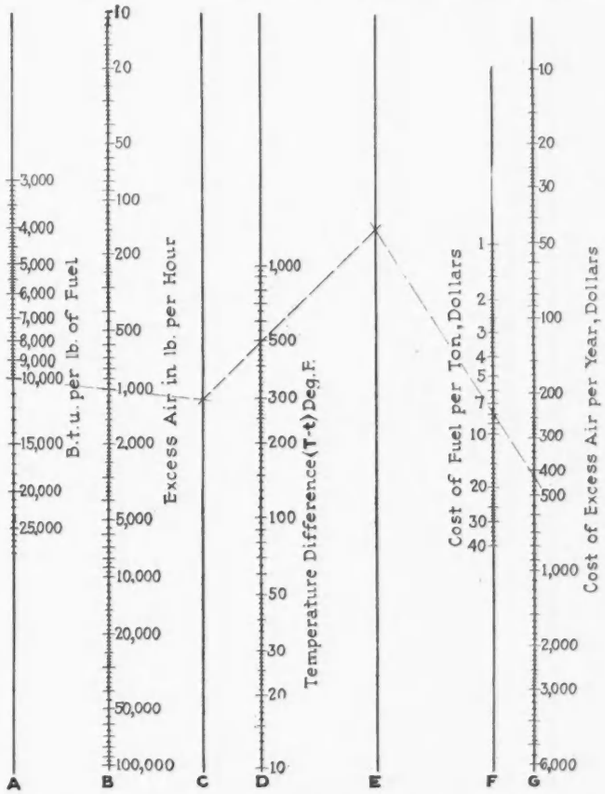


Chart to determine extra cost of fuel involved by using excess air

because of the excess air used. I have chosen $8 as the cost of fuel per ton, giving $420 as the loss.

To determine the excess air per hour in Column *B*,

a measuring device may be needed. As much as 100 per cent excess air is often used; sometimes more. To determine the minimum weight of air required for combustion it is necessary to know, approximately at least, the parts by weight of carbon, hydrogen, and oxygen in 1 lb. of the fuel.

To compute the number of pounds of air required per pound of fuel, divide the weight of oxygen per pound of fuel by 8, and subtract the result from the weight of hydrogen in one pound of the fuel. Multiply the difference by 3. Add the product to the weight of carbon in each pound of fuel, then multiply by 11.6. The result is the number of pounds of air per pound of fuel, usually called the "theoretical amount of air."

Knowing the minimum by computation, and the amount of air actually used by measurement, subtract the one from the other to obtain a value for use in Column *B*.

Should the reader wish to compute the expense involved by the use of excess air per year mathematically, rather than by the use of the chart, it can be done by applying this rule: Subtract the temperature of the air passing into the furnace from the chimney-gas temperature, and multiply by 1.05. Then multiply the result by the number of pounds of excess air used per hour. Then multiply that by the cost of fuel per ton. Then divide by the B.t.u. value per pound of fuel.

Determination of Lead in Silver Bullion

By Fred C. Bond

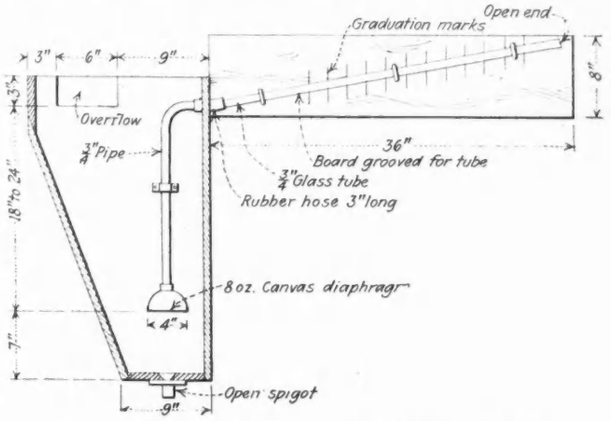
The determination of lead in silver bullion or silver precipitate is usually rendered difficult by the voluminous precipitate of silver chloride which results from the application of the ordinary methods of solution. To prevent this the following method was devised:

Weigh out a 1-gram sample into an Erlenmeyer flask; add 15 c.c. of concentrated nitric acid and heat until the black residue disappears. Add 10 c.c. of water and 5 c.c. of concentrated sulphuric acid and boil to fumes of sulphur trioxide. Cool, add 75 c.c. of water, 3 c.c. concentrated sulphuric acid, and 10 c.c. of alcohol. Filter cold and wash with dilute sulphuric acid solution (1 to 50). Place the filter paper in a casserole and extract with hot ammonium acetate solution (containing 150 grams of ammonium acetate and 15 c.c. of concentrated ammonia in a liter of solution). Decant through a filter paper, add more ammonium acetate solution to the casserole, and repeat. Add 7 c.c. concentrated sulphuric acid to the filtrate and boil to fumes of sulphur trioxide. Dilute to 100 c.c., add 5 c.c. concentrated sulphuric acid; heat to boiling; cool, add 10 c.c. of alcohol, filter and wash with the dilute sulphuric acid. Ignite the precipitate and weigh as lead sulphate. The weight of lead sulphate multiplied by 0.6831 equals the weight of the lead.

If desired the lead dissolved by the ammonium acetate solution may be precipitated as the chromate and the determination finished by the ordinary thiosulphate titration method.

Pulp Density Indicator

In flotation work pulp density is an important factor. Proper control of water inflow and ore tonnage will maintain the pulp density within reasonable limits, but pulp samples must be necessarily tested at intervals. A pulp-density indicator that will give continuous



A pulp density indicator for flotation work

readings affords closer control than the intermittent sampling and testing of the pulp. The accompanying figure shows an arrangement in use at the Sullivan mill at Kimberley, B. C. The pulp inflow to the indicator box is baffled to give a uniform flow. A spigot is provided in the bottom of the box to prevent any accumulation of sand. The indicator tube is filled with water, which may be colored to give greater contrast with the glass tube. Graduation marks are made upon the board to correspond with the limits of pulp density established. Calibration is effected by sampling and determining the pulp density by specific gravity determination.

Grades of Mill Launders

By W. J. Tait

In the accompanying table, I have given the important data affecting the slope of launders at the milling plant of the Timber Butte Milling Co., at Butte, Mont.

Movement of pulp in a launder is called "good" where the flow is steady and the velocity is not such as would cause undue wear in the launders. A "fair movement" is one that requires occasional attention to prevent choking. Some measurements were made of the velocity of flow by timing floats placed in the launder streams. These showed a float velocity of 400 to 500 ft. per minute for flows classified as "good." The average velocity in the launder was probably about 80 per cent of that of the float. The tailings launder showed a float velocity of 420 ft. per minute, and any increase in the coarseness of the sands will choke the launder. A slope of $\frac{3}{16}$ in. per foot has been tried and found unsuitable. The difficulty found with such flat slopes is the maintenance of a uniform gradient, as the launder supports will settle unequally.

Launder Data—Specific Gravity of Ore 32

Screen Analysis of Sands						Water in Pulp, Per Cent	Launder Slope, Inches per Foot	Movement in Launder
—6 Mesh	—20	—48	Plus 65	Plus 100	—200			
100	72.5	46.4	59.5	65.9	26.3	42	2¼ and 2½	Good
.....	Same	.....	.....	.....	.....	..	2	Fair
100	84.9	48.6	55.1	72.5	0	30	3⅜	Good
.....	.....	.....	53.3	71.2	.....	41	1½	Good
.....	.....	.....	61.6	78.7	.....	28	4½	Fair
Tailings (sepcific gravity about 2.9)								
			5	16		83	¼	Good

Discussion

Power Consumption in Single- and Multiple-Compartment Rod Mills

THE EDITOR:

Sir—The accompanying diagrams will serve to demonstrate that the center of gravity of the combined masses of grinding media in a four-compartment rod mill is considerably nearer to the common rotating axis than is the center of gravity of a single-compartment mill. The horsepower given in each instance is calculated solely with reference to the rod load, no account having been taken of the weight of the mills, or of frictional or other losses. To simplify comparison, the rod load, rate of revolution, and diameter of the mills are the same in each case, with one exception—Fig. 4 shows a rod load of 8,200 lb. The average moment arms given are approximately correct, but no assumption of absolute accuracy is made.

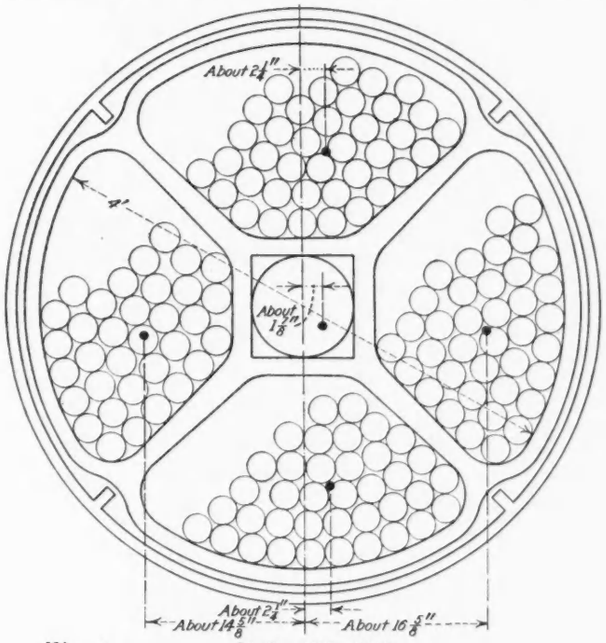
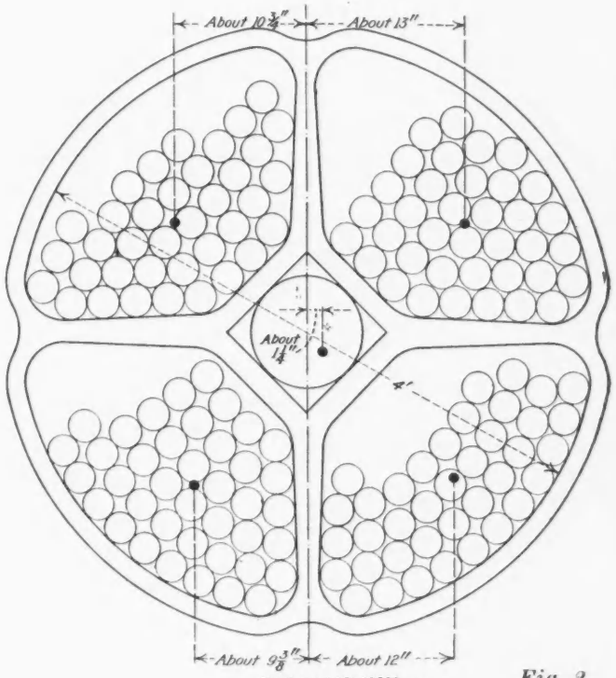


Fig. 1 $Hp. = \frac{26 \times 2\pi \times 1875 \times 13{,}600}{33{,}000 \times 12} = 10.5$

Referring to Figs. 1, 2, and 3: It will be noted that the power required is very much greater in the single- as compared with the multiple-compartment mill, although the load carried is the same. Although the rod load shown in Figs. 1 and 2 represents maximum efficiency in this type of mill, the rod load shown in Fig. 3 is in excess of that usually found desirable in the one-compartment mill, customary operating conditions being represented in Fig. 4, with a load of 8,200 lb. The decrease in load as shown by comparing Fig. 4 with Fig. 3 is accompanied by an almost imperceptible decrease in power. Consequently, a logical comparison of the two types of mills, of the same diameter, would take into consideration the following data:



$Hp = \frac{26 \times 2\pi \times 1.25 \times 13{,}600}{33{,}000 \times 12} = 7$ *Fig. 2*

	Normal Rod Load, Lb.	Power Consumption Hp.
Single-compartment mill...	8,200	30.
Four-compartment mill....	13,600	8.75 (*a*)

(*a*) Average of 10.5 and 7 hp., as shown in Fig. 1 and 2.

The following report of a power test on a four-compartment mill operating dry under full load on cement clinker will serve to emphasize the comparatively small amount of power used in this type of apparatus:

Westinghouse Electric & Manufacturing Company
First National Bank Building
San Francisco

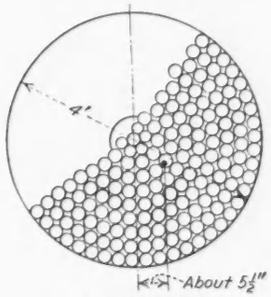
Aug. 23, 1924.

Joshua Hendy Iron Works,
75 Fremont Street,
San Francisco.

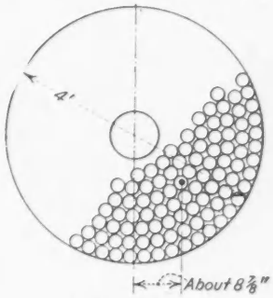
Subject: Rexman Rod Mill

Gentlemen:

As requested by you I made a test of the power input to



$Hp. = \frac{26 \times 2\pi \times 5.5 \times 13{,}600}{33{,}000 \times 12} = 30.8$ *Fig. 3*



$Hp. = \frac{26 \times 2\pi \times 8.875 \times 8{,}200}{33{,}000 \times 12} = 30$ *Fig. 4*

the motor driving a 48x30 in. Rexman rod mill. The mill was running at 28 r.p.m. and had a load of 6,200 lb. of rods.

The instrument used for the test was a Westinghouse portable indicating wattmeter, which had just been calibrated.

The power input to the motor was 3.5 kw., or 4.7 hp. At this load the 20-hp. motor driving the mill would have an approximate efficiency of 81 per cent, so that the approximate motor output was 3.8 hp.

Yours very truly,
(Signed) WILLARD C. JOHNSON,
Industrial Division.

I am hoping to publish at an early date some data on the capacity of a four-compartment mill on various types of material. H. S. REXWORTHY.

Sunnyvale, Calif.

Pedestal Rocks

THE EDITOR:

Sir—The letter of John T. Reid published in your issue of Aug. 23, 1924, page 305, is, so far as I know, the first attempt to use pedestal rocks as criteria of earth stability. They have previously been used as a measurement of time in an instance of glacial erratics resting on limestone pedestals in which the rate of solution of the limestone was determined. They have

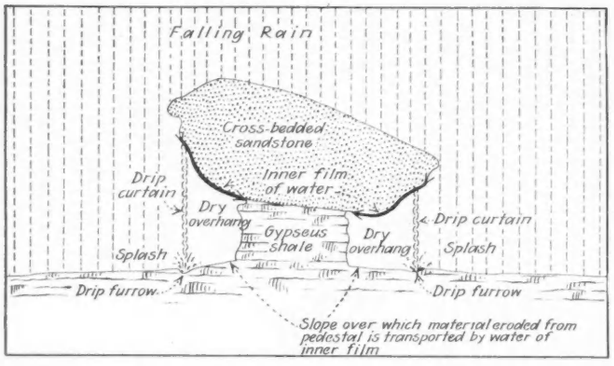


Fig. 1—Cross section through a pedestal rock consisting of a resistant block on a less resistant pedestal to show the process of formation of the pedestal by rainwork

also been used as proof of the absence of glaciers since the formation of the rocks, on the ground that moving ice would destroy them. The object of my paper published as U. S. Geological Survey Bulletin 760-A was to draw attention to the origin of certain of these rocks by rainwash and differential weathering. Mr. Reid believes that the beautiful "Anvil Rock" is due to wind scour, and others have assigned many similar rocks in desert regions to this cause. That differential scour can produce such forms is evident from the occurrence of well-developed pedestal rocks in stream channels where water and its contained sand and gravel are the scouring agents. Four such rocks are described by me in U. S. Geological Survey Bulletin 760-D, now in press. Similar shapes are found also on seacoasts as outliers or "stacks" in front of wave-cut cliffs. Stacks may be undercut by the processes of wave erosion in the same way that "notched cliffs" are formed. Where water is the scouring agent either in streams or on coasts pedestal rocks are short-lived, because with complete development of the form, heavy storm-waves or strong floods almost immediately snap off the pedestal.

As a scouring agent wind with the sand that it may carry is doubtless capable of forming pedestal rocks. There is much difficulty, however, in obtaining definite and concrete proof that wind scour has been the dominant agent in the formation of any one rock, and the mere fact that pedestal rocks are common in arid regions cannot be considered *prima facie* evidence in favor of a wind-eroded origin.

Pedestal rocks that consist of a resistant mass above

Fig. 2—Pedestal rock in the canyon of Jemez Creek between the town of Canyon and Jemez Hot Springs; sandstone block on shale. The pedestal is free from the bank of which it once formed a part

resting on a more easily eroded pedestal are formed principally by rainwash, as observed by me near Lees Ferry, Ariz., and illustrated in the diagram of Fig. 1.

In this figure the rain is represented as falling vertically, and its effects are symmetrical so far as the irregularities of the block permit. When the rain is accompanied by wind, the drip curtain will be driven in toward the pedestal on one side and falling raindrops may even be driven against the pedestal. That this process will produce all the features of the rocks at Lees Ferry seems certain from the observations recorded in Bulletin 760-A. The same process doubtless affects most pedestal rocks. The work of the inner film of water which creeps along the overhang of the block and runs down the pedestal is most important, since it is the work of this water which erodes back of the drip curtain and thins the pedestal. During the rainstorm observed by me at Lees Ferry the inner film reached just to the top of the pedestal. That the film may not only reach the pedestal but may in suitable circumstances erode it is shown in the photograph of a rock in the canyon of Jemez Creek, N. M. (Fig. 2). This rock consists of a loose block of red sandstone derived from outcrops up hill and resting on red shale. As shown in the photograph, taken in 1923, the pedestal is marked by a vertical roll of hardened mud exactly similar in character and origin to the streaks of mud formed on the inside walls of adobe houses when the roof leaks. The continuation of this process leads to removal of all

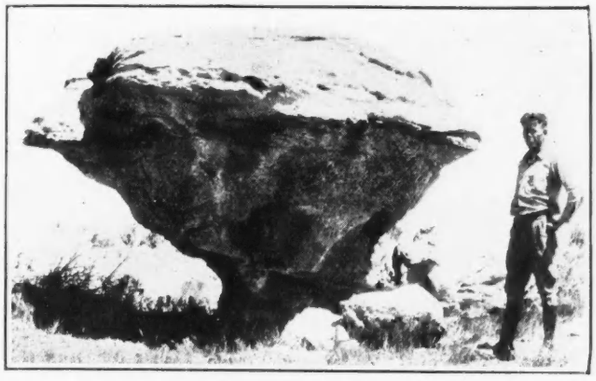


Fig. 3—Pedestal rock of sandstone, McKinley County, N. M.

material on the pedestal already loosened by differential weathering.

Variations in differential erosion are almost infinite, and some characteristic processes are recounted in Bulletin 630-A. The formation of pedestal rocks in sandstone was not treated in this paper, but was studied to great advantage this last summer in northwestern New Mexico, where thousands of such rocks occur. The well-shaped pedestal rock shown in Fig. 3 is situated about 20 miles northeast of Crownpoint, in McKinley County, N. M. It stands on a sloping plain near a small dome-shaped outcrop of sandstone. As may be seen from the photograph, the sandstone is massive, cross-bedded, and essentially horizontal. It is one of the massive buff-colored sandstones typical of the Upper Cretaceous in this part of New Mexico. It is impossible for wind scour to be the effective eroding agent, for the following reasons: (1) The presence of grass, herbs, and desert shrubs shows that not much sand is in motion, else these plants would restrict movement of the sand or be cut away; (2) no large amount of sand has been in motion in the area during the recent past at least, for there are near by only small bodies of sand one foot or two feet thick, fixed in position by the growth of grass; (3) the rock has a soft and friable surface unlike the harsh firm surface characteristic of sandstones of the region that are scoured by wind-driven sand. The pedestal rock seems to have originated from a squarish block that was separated from the main outcrop by erosion on joint planes. In that stage the upper more resistant layer became rounded by weathering —a characteristic of adjacent outcrops. The sidewalls of the rock were, however, cut back to form the pedestal by a combination of processes. As the overhang begins at a bedding plane it is fair to assume that the lower part of the rock was originally somewhat less cemented and individual sand grains were detached more easily. These loosened grains would fall by gravity or be carried away by rainwash or the wind. Since the upper part of the rock is porous, all the rain that falls does not run off, but part is absorbed to emerge lower down. In this seepage the cement is dissolved, and the rock becomes soft and friable, especially near the base.

The relatively slow process of detachment of loosened grains is interrupted by the fall of large fragments. The scars of such falls can be seen in the photograph and divide the face of the pedestal into fresh and old surfaces. Doubtless freezing temperatures when the rock is saturated are effective in this work. The older surfaces are minutely pitted, and many of the pits inclose the shells of insect pupæ. Apparently, one of the wasps bores holes in such surfaces for nests, and thus contributes to the erosion of the pedestal.

The foregoing brief review of some of the processes by which pedestal rocks are formed gives a fair idea of the difficulty in interpreting these striking, if minor, land forms. To establish origin by wind scour requires that the neck or pedestal show suitable abrasion, that sufficient supplies of drifting sand be available, and that also all other processes can be eliminated from consideration.

KIRK BRYAN,
Washington, D. C. U. S. Geological Survey.

An Open Gold Market

THE EDITOR:

Sir—May I make some comments on the letter of W. J. Loring, entitled "An Open Gold Market," in your issue of Sept. 27, 1924, page 501? Mr. Loring desires to assist American gold mining and suggests relief from present high taxation and charging industrial users of gold more than the statutory 20.67 dollars per ounce for the gold they buy. Regarding the former I can offer no comment. I cannot see that Mr. Loring states any case for the latter. He seems to infer that the United States Government has treated American gold producers badly, presumably in buying their product at less than market value. This is the reverse of the fact. The United States Government, by its action in absorbing all gold offering at 20.67 dollars into inoperative stock and maintaining the value of the dollar, has saved gold from a great further decline in value. It has thus greatly assisted American gold producers as well as others and it has paid a price in so doing—that is, it has lost the interest on many hundreds of millions of dollars.

His statements that British gold mining has benefited by the exchange rate between the dollar and the pound and that the exchange rate has been consciously created for the benefit of British gold producers by the British Government are incorrect. The British pound has been worth only whatever its exchange price in dollars has been at the moment. British gold has been and is being sold at 20.67 dollars, just as is American gold.

Mr. Loring then proceeds to advocate a course that would tend to reduce gold value—that is, to eliminate the use of gold and therefore the loss that accompanies its use. The future value of gold depends upon the future monetary policy of the world. Its partial demonetization since 1914 has reduced its value 35 per cent. Its effective remonetization would increase its value proportionately to the extent of the remonetization.

If the United States Government believes that effective remonetization (increase in gold value) will come, then Mr. Loring's most hopeful course of action would seem to be to induce the government to give temporary support to United States gold mines, on the ground that permanent loss (through mines closing down) would be thus avoided. But if gold is going to remain at its present value, there is no case for artificially supporting gold production.

It is indeed possible that, if other nations permanently adopt new monetary systems, the United States will see the value of her large gold stocks decline.

Perth, Western Australia. H. R. SLEEMAN.

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 American Smelting & Refining Co. has increased the dividend rate on its common stock from 5 to 6 per cent annually. Dividends at the former rate were resumed in August, 1923. Prosperity in the mining industry is reflected.

Wages of miners in the southeast Missouri lead-mining district have been increased 10 per cent, partly on account of the better price for lead.

The Barnes-King Development Co., having failed to find an attractive mining enterprise to develop, has decided to distribute the $250,000 cash on hand.

A second important copper-gold orebody is said to have been developed by the Noranda Mines Co. in northwestern Quebec.

Gold production from Leadville, Colo., totaled more than $1,000,000 in 1923, gold for the first time being the most important metal.

By Feb. 1 it is expected that 165 mills will be operating in the Joplin-Miami zinc-lead district.

Bisbee, Ariz., mining companies are employing 3,280 men, which is nearly as many as during the war. The monthly payroll is $465,000.

Pine Creek operators in the Cœur d'Alene region declare they have 500,000 tons of lead-zinc-silver ore ready for shipment when and if a railroad is built.

Members of the Institution of Mining and Metallurgy in London find its reputation somewhat tarnished by the Porcupine-Davidson fiasco in Ontario.

Much copper will be used in the $50,000,000 project of the Pennsylvania Railroad in electrifying its main line between Washington and New York.

Of the 9,673,000 yards of material moved from Sacramento Hill, at Bisbee, Ariz., only about 12 per cent has been ore.

Phelps Dodge Has Moved 9,673,000 Yd. at Sacramento Hill

Seventeen Benches When Work Is Completed—One-eighth of Tonnage Is Ore

Sacramento Hill operations by the Phelps Dodge Corporation at Bisbee, Ariz., made progress during 1924. Two benches were entirely finished during the last twelve months, one a 60-ft. bench and the other a 45-ft. bench. With the completion of the two, five benches are now entirely completed on the north and south sides of the pit. Two more benches are entirely finished on the south side, and shovels are working on them on the north side. Two new benches were opened during the latter part of the year, both 30 ft. high.

When the work is completed there will be seventeen benches in the pit and the bottom of the last bench will be 710 ft. lower than the original top of Sacramento Hill. A total of 9,673,000 cu.yd. of material has been moved since April, 1917, when work was first started; 2,225,000 yd. of of this material has been removed during 1924. Of this total only 1,100,000 cu. yd. has been ore. Almost eight trainloads of stripping have been moved for every trainload of ore.

Four shovels are now working in the pit, and a spare shovel is kept there at all times. The hill maintained an average of 9½ shovel-shifts per twenty-four-hour day during 1924. An average of 2¼ trains is maintained with each shovel on both day and night shifts. The stripped overburden has been sent to waste dumps or to leaching dumps, depending on its copper content.

The new Copper Queen concentrator, finished more than a year ago, has been working throughout the year, though at less than maximum capacity.

A. S. & R. Increases Dividend Rate on Common Stock

COMMON stock of the American Smelting & Refining Co. has been placed on a 6 per cent annual dividend basis by the declaration of a quarterly dividend of $1.50 a share. Since the resumption of dividends, on Aug. 1, 1923, the company had paid $1.25 a share quarterly, or at the rate of 5 per cent a year. The new dividend is payable Feb. 2 to stock of record Jan. 16. The company also declared its regular quarterly dividend of $1.75 a share on preferred stock payable March 2 to stock of record Feb. 6. The increased dividend reflects prosperity in the entire mining industry.

Henry Ford Abandons Southeast Missouri Lead Drilling

Local Operators Criticise His Methods —St. Joe Continues Mine la Motte Prospecting

The Henry Ford interests have given up their options on about 10,000 acres of lands in St. Francois County, Mo., largely near Bonne Terre, where they had been operating six to eight drills for about a year. Four or five tracts, aggregating about 2,000 acres, have been drilled. The results seem to have been unsatisfactory, for the drills have been shipped back to Michigan. Some who are familiar with the district declare that Ford failed to utilize the experience of local operators, and that the drilling was inconclusive. It is not the first time that outsiders have turned down property that subsequently, on more thorough drilling, has proved to be valuable. Three or four holes on a forty-acre tract in the Joplin district was once supposed to be ample to determine its value, but the Miami district has shown that it requires twenty to fifty holes on forty acres to make a fair test.

The St. Joseph Lead Co. still retains its option on the old Mine la Motte property, where it has found several good deposits of disseminated lead at much greater depths than formerly —even to 600 ft.

Penn. Railroad's $50,000,000 Electrification Will Require Much Copper

THE electrification of the lines of the Pennsylvania Railroad between Manhattan Transfer, (just across the river from New York City) and Washington, D. C., is assured. The cost of the work will be approximately $50,000,000. The stretch between Wilmington, Del., and Philadelphia, Pa., probably will be the first section to be altered. Numerous conferences have been held with representatives of the railroad, of the Westinghouse Electric & Manufacturing Co. and the Philadelphia Electric Co. It is understood that the Westinghouse company will receive the contract for the electrification, and that the power will be supplied by the Philadelphia Electric Co. and associates. It is understood, also that overhead wires similar to those now in use on the company's main lines outside of Philadelphia, rather than a third rail, will be used to supply the current for the operation of the electric locomotives. Many million pounds of copper will be required before the equipment is in running order.

Second Rich Strike at Gilbert, Nevada's New Gold Camp

A new and rich outcrop discovery has been made at Gilbert, in the Desert mining district, 29 miles westerly from Tonopah, Nev. This discovery is 4,000 ft. south of the original strike, which aroused interest in the camp of Gilbert a month ago. It is probably on the same rhyolite dike as the original strike, at a point where there is a massive and prominent silicified outcrop more than 40 ft. wide, on ground which is under option to the same interests as control the original strike.

The extent of the ore on surface is unknown, as practically no work has yet been done. The particular spot where a few holes were blasted shows abundant free gold and bands of silver sulphides in quartz. Assays of more than $5,000 have been obtained, with 95 per cent of the values in gold, and the ore is being closely guarded against high-graders. The country is well staked, there are already about a dozen houses on the ground, a store building is being constructed, and the district is overrun with prospectors. It is hoped that weather and other conditions will permit of some real work being started soon.

Hardy Buys Zinc Concentrate

Charles Hardy, of New York City, has contracted to buy the zinc output of the El Potosi Mines Co., in Chihuahua, Mexico, for three years. The zinc concentrates of this company will be shipped to Europe, where a shortage of zinc ores and concentrates has been known to exist for some time. The output of the mines is estimated to be about 50,000 tons annually.

Joplin-Miami District Thrives

Expect 165 Mills to Be Operating by February 1—Older Area Will Be Opened as Consequence of Good Metal Prices

By P. R. Coldren
Special Correspondent

CONTINUED ACTIVITY, with increased production, and numerous transactions involving leases are reported from the Joplin-Miami zinc and lead district. It is estimated that not fewer than 165 mills will be operating by Feb. 1.

The Underwriters Land Co. has placed its No. 6 mill in operation and may start its Waxahachie plant before the end of the month. The Quapaw Mining Co., a Schwab concern, has started its Davenport mill. The Century Zinc Co. is completing a mill south of Baxter Springs, Kan., which will be producing in a few weeks. The Annex Mining Co. is completing a small mill near that of the Century. The Kansas Explorations Co. will start its Isherwood mill in the Crestline, Kan., field in the immediate future. The Barnsdall Zinc Co. is completing a concentrator on the Hartley lease, west of Baxter Springs, and the Wallerstead Mining Co. has just started a new mill in the Crestline field. The Eagle-Picher Lead Co. will have its Ellis mill in the Crestline field and its new mill at Bricefield, south of Pierce City, Mo., ready for operation within the next week or so.

Up until a few weeks ago operation of night shifts at the various properties amounted to a very small percentage of the whole activity. With good prices and continued demand for ores, many companies are now adding night shifts, and it is estimated that the output of the field will be greatly increased as a consequence. Some estimate that the weekly production will reach 18,000 tons in the near future, provided ore prices hold.

Besides pushing production at established mines, most companies are seeking new properties. The Federal Mining & Smelting Co. recently took over a lease of 6,000 acres of leases of the American Zinc, Lead & Smelting Co., in the vicinity of Granby, Mo. The Federal company has moved a number of drill rigs on the land and plans full development.

The Golden Rod Mining & Smelting Co. has taken a lease on the East Side or Monarch mine, east of the Blue Mound, on the Kansas side of the Kansas-Oklahoma state line, just north of Picher, Okla. The property consists of a 160-acre lease, equipped with a large mill. Drilling on the acreage already has been begun. The Golden Rod Co. also has taken a lease on the Pyramid mine, southeast of Picher.

F. W. Evans, of Picher, has taken a lease on the Leonora mill and lease, situated south of Picher. He also has been drilling on his lease just east of the Peru mine, southwest of Baxter Springs, Kan., and plans further development there, and has taken a drilling option on the Oakley lease, in the Crestline (Kan.) part of the field.

One of the former heavy producing mines of the sheet-ground field is to be reopened. The Burch Lead & Zinc Co. has taken a lease on the old A. W. C. property, which is about two miles west of Joplin, and will unwater the ground and construct a 400-ton concentrator immediately. The mine was formerly a steady producer, and was at one time sold for $300,000. At that time it had three mills. There are a number of shafts to the ore level, which is about 175 ft. At present the water comes to within 60 ft. of the surface, and a 10-in. "Texas" pump is being installed for unwatering operations. It is expected by the time the ground is drained the mill will be ready for operation. The ground formerly showed slightly better than 3 per cent recovery, almost one-half of which was lead. I. L. Burch, of Joplin, is manager for the company.

Snowstorm Will Sink Winze and Drift at Depth

Sinking of a three-compartment winze for an additional depth of 650 ft. has started in the Snowstorm mine, near Troy, Mont., Leo Greenough, manager, has announced.

The program, which has been financed, will be to cut stations at the 400 and 600 depths and start drifting each way from the winze. It is planned to drift at the rate of 1,000 ft. per month as soon as the depth has been attained.

The winze was started in the main tunnel about one-half mile from the portal and was sunk 200 ft. below the tunnel level, where a drift 1,200 ft. long was driven on the vein, which carried ore all the way. The additional depth of 650 ft. will open up a large amount of ore for the mill, which will start May 1. The ore is transported from the mine to the concentrator over a 5½-mile steam railway.

Franklin Ready for Active Exploration of Kearsarge Vein

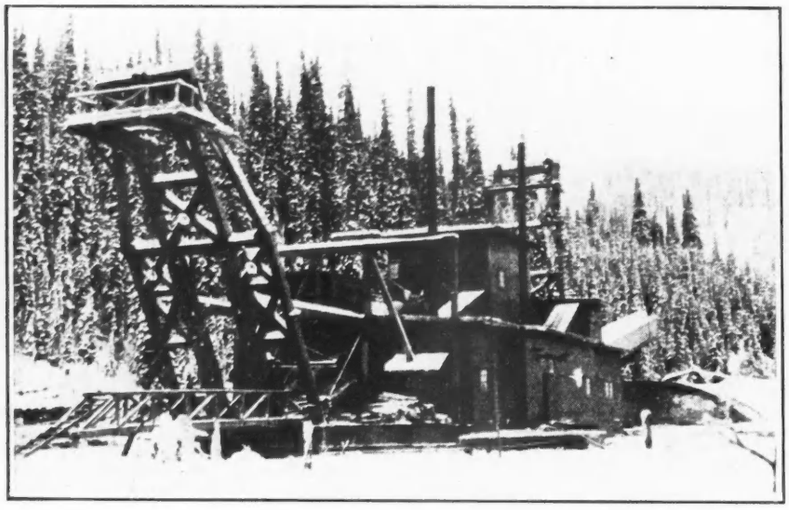
At Franklin's Kearsarge lode exploration, in the Michigan copper district, the new permanent, incline shaft has been holed through into the raise from the vein. The lode was located by means of a crosscut from a temporary shaft. The bottom of the shaft now is being cleaned out, and sinking then will continue in the vein. The formation is described as good-looking vein rock with enough copper in it to show that it is "alive." The depth of the shaft from surface to bottom is 110 ft. The shaft went down nicely into the raise, 30 ft. up from the vein. Commercial values are not expected until greater depth is reached, as the vein has just been entered. The lode will be subjected to thorough examination. Much interest is taken in this exploration in the Lake district, as it is the first time the Kearsarge vein has been opened so far to the south.

Cold Weather Finally Shuts Down Antler Creek Dredge

New Boat Erected Last Summer—Machinery from San Francisco —To Resume in March

The Kafue Copper Development Co.'s dredge on Antler Creek, in the Cariboo district of British Columbia, has been shut down for the midwinter months, after making a trial run that was successful in every way. During the last two weeks of the year temperatures of 10 to 20 deg. below zero were recorded at many points in interior British Columbia. C. A. Banks, who is the local representative of the Kafue company, says that he expects to renew operations in March. The Kafue company built the hull for the dredge, with lumber sawn at its own mill, which was erected for the purpose.

The machinery was supplied by, and erected under the supervision of, the Union Construction Co., of San Francisco. The dredge has 103 4-cu.ft. nickel-steel buckets, and it is expected that it will develop a capacity of 2,500 to 3,000 cu.yd. per day. The freighting of the 300 tons of machinery from Quesnel, the present terminus of the Pacific Great Eastern Ry., to Antler Creek, a distance of 70 miles, was one of the chief difficulties of construction.



Snowed In!

The gold dredge of the Kafue Copper Development Co. in northern British Columbia

Copper-Steel Alloy Makes Best Electric Transmission Pole

The problem of devising the best pole to carry electric power transmission lines has given serious concern to public service and power companies. Wood and reinforced concrete have in many instances given way to structural steel. Impetus is given to this trend by the development of a copper-steel alloy containing about 0.15 per cent copper, which is highly rust resistant. This method of constructing poles is considered to be better than galvanizing for the reason that the entire thickness of the metal resists corrosion. Recently the Truscon Steel Co. designed a new pole of copper-steel alloy.

Big Elk Mill Burns

Fire destroyed most of the concentrating plant of the Big Elk Mining Co., in Kansas, two miles northwest of Picher, Okla., early in January. Damage was estimated at $75,000. The origin of the blaze is thought to have been in the pump house, where frozen water pipes were being thawed. Impaired telephone service, due to the heavy sleet storm, caused delay in getting the alarm to the Picher fire department, which did good work after it finally reached the scene, preventing complete destruction of the plant and spreading of the fire to other properties.

The Big Elk Co. is made up mostly of Miami, Okla., men, J. T. Whaley being president, J. R. Simpson secretary, and C. L. Kelly superintendent.

Michigan Copper Producers Seek Rate Cut on Shipments East

Calumet & Hecla Consolidated has applied to the Interstate Commerce Commission for a reduction of the present copper-carrying rate on railroads from Michigan to Eastern points. The present rate from the Michigan district to New York is 57c. per 100 lb. in winter and 48c. in summer, when the Great Lakes transportation lines are in competition with the railroads. Calumet & Hecla asks a rate of 35c. the year around. It is contended the present charge is unreasonable, the rate on copper shipments from Montana to New York being only 62½c.

No decision has yet been handed down by the Michigan Public Utilities Commission on Calumet & Hecla Consolidated's request for a rate of 25c. the year around on copper to Detroit and other Michigan points. The railroads have voluntarily reduced their rates to 30c. the year around, a reduction from 47c. in winter and 38c. in summer. The 30c. charge is now in effect to Michigan points and also to Chicago. Calumet & Hecla contends that the rate should be further reduced to 25c.

Much Zinc-Lead-Silver Ore in Pine Creek

Operators in the Coeur d'Alene Want O.-W. R. & N. to Extend Railroad Spur

Half a million tons of lead-zinc-silver ore stands ready for removal in mines of the Pine Creek district of the Coeur d'Alene region, in Idaho, according to an announcement made at a short meeting of the Pine Creek Mine Owners' association recently. Additional ore may be exposed as development proceeds. This ore will go over the O.-W. R. & N. if the railroad will extend for 7 miles the spur built two or three miles from the main line at Pine Creek junction. The purpose of the meeting was to gather data on tonnage for presentation to the railroad, that it might be in a position to consider the merits of the appeal for transportation.

Advantage of improved zinc prices is being taken by the Constitution Mining & Milling Co., which has been shipping continuously for several months from its property on Pine Creek. In addition to zinc it is moving lead-silver concentrates at intervals.

The Nabob Silver-Lead Co. has completed arrangements for the shipment of its lead-zinc-silver ore to the Timber Butte mill at Butte, Mont., for concentration. Underground development at the Nabob during the last few months is said to have been most satisfactory, a large tonnage of ore being opened and stopes prepared for extensive operations. The tramway from the mine to the main road, burned during the August fires when the company also lost its concentrator, has been rebuilt and is in working order.

A resumption of operations on the Amazon-Manhattan mine is encouraged by recent advances in the price of zinc. The property is convenient to the Ray-Jefferson mill, which has dressed its ore, and to the Beaver branch of the O.-W. R. & N. A recent inspection of the branch by railroad officials has given rise to a hope that its repair and the production of ore will be resumed.

Ore containing zinc is found elsewhere in the Coeur d'Alene region. The Ore-or-no-go vein of the Hecla Mining Co. contains an important percentage of that metal.

Britannia Mine Produced 26,400,000 Lb. of Copper in 1924

The Britannia Mining & Smelting Co., operating the Britannia mine, on Howe Sound, British Columbia, milled 844,000 tons of ore during 1924, which yielded 64,700 tons of concentrate, containing 26,400,000 lb. of copper, 126,500 oz. of silver, and 4,500 oz. of gold. The company curtailed output sharply when copper dropped below the 13c. mark, preferring to conserve its ore reserve rather than sell at that price; otherwise the output would have been considerably larger. The Howe Sound company, the holding company for Britannia and two Mexican companies, disbursed one dividend during the year which amounted to 5 per cent on the capital of the corporation.

At Bisbee, Ariz., 3,280 Men Earn $465,400 Monthly

Total Force Near That Preceding Shutdown in 1921—Central Copper Employs 245 Men

Companies and lessees operating in the Bisbee district, in Arizona, are now employing a force of men closely approximating that employed before the shutdown in 1921. The total of 3,280 men is distributed as follows:

Name of Company	Employees
Phelps Dodge (Copper Queen Branch) underground and surface force	1,049
Copper Queen concentrator	538
Calumet & Arizona Mining Co.	1,000
Shattuck-Arizona Mining Co.	175
Wolverine and Arizona Mining Co.	35
White Tail Deer	30
Night Hawk	35
Boras Leasing Co.	20
Irish Mag Leasing Co.	15
Del Norte Leasing Co. (old Hoatson mine of C. & A.)	10
Thirty-four separate leases on Copper Queen ground	215
Total	3,280
Average monthly payroll of above companies	$465,400

In addition to the above-listed forces, approximately 635 men are engaged in mining and leasing in other parts of Cochise County, outside the Bisbee district, such as Tombstone, Courtland, Gleeson, Pierce, Dos Cabezas, and other mining districts. At Tombstone, 110 men are employed, and the Central Copper Co., at Dos Cabezas, has 245 men at work. It is estimated that approximately $65,800 is paid out monthly for wages in these outside districts, making the total monthly payroll of Cochise County, for wages to men employed in mining, $531,200.

Unable to Find a New Mine, Barnes-King May Dissolve

The directors of the Barnes-King Development Co., at a meeting held on Jan. 8, at Butte, Mont., voted to submit to the stockholders of the corporation a proposition for distributing the liquid assets of the corporation and for dissolution of the company.

The company is a Montana corporation, with 400,000 shares of stock issued and outstanding, and has approximately $250,000 in cash in treasury. It owns four mining properties in the state, all of which are in the Marysville district. The company has spent large sums of money on extensive development work in search of new mining property in the last two years, but to date has not found any that will take the place of the old producers, which are to be abandoned.

Building Boom Boosts Copper, Says Kruttschnitt

In an interview at Los Angeles recently, Julius Kruttschnitt, Jr., of the American Smelting & Refining Co., Tuscon, Ariz., is reported to have credited the building boom, a feature of recent southern California development, as a major cause for the increased demand for copper since the war. Other favorable influences, he said, included the wider utilization of electrical appliances and the stimulation of interest in the radio.

Cerro Gordo Finds Ore on 1,100 Level

The famous old Cerro Gordo mine, situated in Inyo County, Calif., 6 miles from Owens Lake, produced and shipped, during 1924, to the smelters of the United States S., R. & M. Co., at Midvale, Utah, and Kennett, Calif., 1,523 tons of silver-lead ores, of a gross value of $45,323, or an average value of $29.76 a ton. In addition, it shipped 15,000 tons of calcium limestone, valued at $30,000, to the Natural Soda Products Co.'s plant, 8 miles distant.

Special significance attaches to the metal yield in that about one-third of the year was consumed in sinking operations from the 900 level to and below the 1,100 point, and the extension of laterals for exploratory purposes. At two points on the 1,100 level, and in a winze below it, ores of a character and value corresponding with the early output of the mine, it is claimed, are being opened. These disclosures may be the downward continuations of the China, Omega, and Santa Maria orebodies, which gave Cerro Gordo a production record of around $21,000,000 up to the time of the close of the World War. It has always been the accepted theory that the ore was bottomed at 900 ft., but this seems to be disproved by the recent work.

Would Exclude Non-British from Canadian Gold Fields

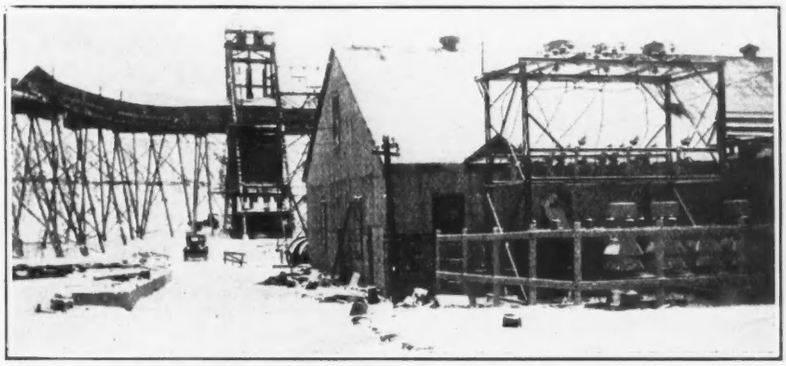
The Hudson's Bay Co. has made arrangements to erect a trading station and hotel at Dease Lake, British Columbia, in contemplation of a rush of miners to the new placer field on Gold Pan Creek, which was discovered last fall.

With the possibility of the discovery of a rich gold field at Dease Lake, the British Columbia Chamber of Mines, the Vancouver Board of Trade, and other public bodies are petitioning the Dominion Government to enact legislation providing that mineral lands in Canada shall be staked in the future only by British subjects. It is understood that already a number of persons from Alaska and the Pacific Coast states have made arrangements to go to the new gold field as soon as the season opens.

Leetonia Mine, on Mesabi Range, Now Electrically Operated

Bennett Mining Co. Has Modern Equipment at Kewatin—New "Dry" Finished

The Leetonia mine, controlled by the Republic Iron & Steel Co., at Hibbing, Minn., is again in active operation after a shutdown to change over the mine machinery from steam to electric drive. The two-drum steam hoist was scrapped and replaced by a one-drum second-motion Ottumwa Iron Works hoist driven by a 150-hp. motor. An old 1,000-cu.ft. Imperial Type 10 compressor was belt-connected to a 200-hp. motor; and a 150-kva. motor-generator set takes care of the underground haulage. The underground electric pumps, of small size, were installed several months ago. The new substation containing three 250-kva. transformers reduces the voltage from 22,000 to 440 volts, and this potential is used for all mine motors. Current is purchased from the Minnesota Power & Light Co.



Leetonia shaft near Carson Lake

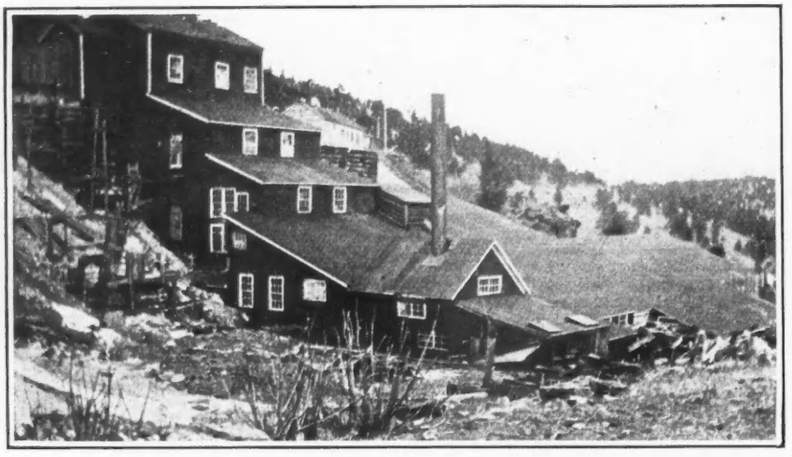
The Republic Iron & Steel Co. has completely electrified this plant on the Mesabi Range

On Jan. 6 Shaft No. 2 of the Bennett Mining Co., at Keewatin, started hoisting ore. This shaft is equipped with the most up-to-date mining machinery on the range. The 1,000-cu.ft. Ingersoll-Rand compressor operates at 256 r.p.m., which is maximum speed for this size of machine. Both cage and skip hoists are equipped with liquid rheostat control, the only installation on the range. Endless-rope engines driven by 40-hp. motors operate two top tram cars. A new dry house with capacity for 160 men is complete with the exception of lockers. This shaft is 250 ft. deep and has a maximum capacity of 50,000 tons per month.

Nevada Mine Operators Contract for 1925 Cyanide

The Nevada Mine Operators' Association has closed a contract with the American Cyanamid Co. for 1,000 tons of cyanide for Nevada mills in 1925. This is the minimum figure, with a possibility that much more will be consumed. Nevada mills are the largest consumers of cyanide in America.

The contract insures cyanide for every milling company operating in Nevada.



The Boulder County mill, in Colorado

This plant recently was taken over by the Fairview Mining Corporation to be operated in conjunction with the Boulder County and Trojan properties, on Idaho Hill, at Cardinal. The mill is being remodeled for selective flotation, and a large force of miners is employed in retimbering and clearing out the old mine workings.

Fairview Fluorspar Sale Ends Picturesque Financial Story

John Mulholland Bonds, Widely Held, Will Be Paid in Full—Money Lender Failed As Miner

The Fairview Fluorspar & Lead Co., operating in Hardin County, Ill., now is paying off in full the balance due on a $1,836,741 issue of composition certificates signed by the company and the late John Mulholland. Seventeen years ago, when Mulholland met financial reverses, the certificates were held by 800 of his creditors. His obligations totaled $2 045,741, and he had few liquid assets. The Fairview Fluorspar & Lead Co. assumed the burden of caring for Mulholland's creditors. For several years the company enjoyed good business and up to Oct. 10, 1922, had paid off a total of 31 per cent of the original face value of the certificates. Recently the company sold all of its assets, with minor exceptions, to a subsidiary of the Aluminum Company of America for $1,620,000. This will enable the company to pay in full all of the Mulholland certificates outstanding.

Mulholland had a picturesque career. Prior to 1900 he was a saloonkeeper in Kansas City, his place of business being across the street from the court house. He made a specialty of "shaving" jury warrants. Later he branched into the money-lending business, and in a few years outgrew Kansas City, moving to New York. Subsequently he opened branch offices in all of the principal cities of the East and Middle West. In those days he was known as "The Prince of American Money Lenders."

To obtain new capital he issued what he termed "John Mulholland Bonds" and raised $1,850,000 in all parts of the country. He then entered other branches of industry. He acquired a small railroad in Texas, a water company in New York, silver mines in Colorado, and the fluorspar mine in Hardin County, Ill. The latter was incorporated in 1905 as the Fairview Fluorspar & Lead Co.

Mulholland was not so successful in other fields as he had been as a money lender. He withdrew capital from that business to keep up his other concerns, and finally there was a complete collapse of all his ventures. The Fairview Fluorspar & Lead Co. stock was in the name of his wife and was not directly affected by his failure. However, it agreed to care for his creditors, and they will be paid in full.

Victor C. Alderson Dropped by Colorado School of Mines

Victor C. Alderson, president of the Colorado School of Mines, at Golden, Colo., will not succeed himself. The trustees adopted a resolution recently declaring the presidency of the school vacant from and after Sept. 1 next, the date on which Mr. Alderson's term expires, says Max W. Ball, secretary.

At the meeting of the board Mr. Alderson expressed the desire to be considered for reappointment. It was decided, however, to declare the presidency vacant after Sept. 1 and to start immediately to select another man for the position and that no further consideration be given Mr. Alderson for reappointment. Mr. Alderson has been the center of considerable acrimonious strife for many years.

Other members of the board of trustees of the school in addition to Mr. Ball are Rodney J. Bardwell, president, and Horace F. Lunt, William H. Smiley, and Robert H. Sayre.

Utah-Apex Earnings at Bingham Increase with Lead Price

The Utah-Apex mine, at Bingham, Utah, shows operating profits of $177,657 for the first three months of its fiscal year—September, October, and November, 1924. Earnings for each of the three months were: September, $25,000; October, $74,986; November, $76,986—the increase from month to month reflecting the rising price of lead. The rate of profit for the quarter was more than $1.30 a share on the 528,000 shares, before depreciation and depletion.

Supreme Court Reverses Iron Cap-Arizona Commercial Decision

Latest Opinion Finds Verdict Favoring Iron Cap Too Broad—$3,000,000 Involved in Suit

Judgment rendered in Arizona by the Gila County superior court in favor of the Iron Cap Copper Co., in an apex suit brought by it against the Arizona Commercial company to quiet title to its mining claims, was recently reversed by the State Supreme Court and the case remanded to the lower court for the purpose of entering judgment in accord with the opinion.

The case at issue is an outgrowth of a controversy between the two mining companies, whose properties adjoin in the Globe district. The initial action was brought in February, 1919, when the Arizona Commercial brought suit in the State of Massachusetts, alleging that the Iron Cap had wrongfully extracted ores to the value of $3,000,000. In the following September the Supreme Court of that state refused to hear the charges, on the plea of the Iron Cap that it involved a question of title, and directed that the case be heard in an Arizona court. The Arizona Commercial then began another suit under the Massachusetts laws, and also started action in the Maine courts, asking that the Iron Cap be enjoined from disposing of any of its assets until a settlement was made. As a result of these suits the Iron Cap brought suit in the Arizona court to quiet title to the orebodies in dispute. Proceedings in the Maine courts were held up pending a decision.

It is the contention of the Arizona Commercial company that certain veins which the Iron Cap was working are extensions of veins of which the Arizona Commercial owns the apices, but that the portions being worked by the Iron Cap have become separated from the apices by faulting. The substance of the reversing decision by the supreme court is that the lower court's decision was too broad—that is, that in quieting title to the Iron Cap claims it disposed of, by judicial decree, undiscovered and undeveloped veins, which, in the light of later development, might rightly belong to the defendant.

Leadville's Gross Production Just Under $500,000,000

The gold production in Lake County, Colo., comprising the Leadville district, in 1924, for the first time in its history, exceeded in value that of any other metal. In 1923 the gold output was 14,000 oz., worth $280,900, compared with 52,000 oz., worth $1,084,840. This remarkable increase was due principally to discoveries in the Ibex, where, during the last year, leasers have uncovered pockets of unusually rich ore, of a character which brought this mine into national prominence as a gold producer in 1893.

Twenty-four sets of leasers are now employed on the property. The value of the total production from Leadville mines up to and including 1924 is only a few thousand dollars less than $500,000,000.

Wages Are Advanced 10 per Cent in Southeast Missouri

AN increase of 10 per cent in wages of mine employees has been put in effect in the lead-mining district of southeastern Missouri. The former base rate was $4.55 for shovelers and $4.60 for drill runners, the new scale being $5 and $5.05 respectively. This is in excess of the highest paid during the war period.

The St. Joseph Lead Co. is the principal producer in the district, where about a third of the lead produced in the United States is mined. The high price of lead is stimulating activity, and "gopher" diggings are being opened in various sections of the district by small operators.

Increased Reserves in Old Dominion Mine in Washington

Recent discoveries in the Old Dominion mine, near Colville, Wash., have added greatly to the known ore reserves, according to W. H. Linney, general manager of the Dominion Silver Lead Mining Co., which operates the mine.

Mining activities have been confined to an oreshoot found on the 700 level, but recently exploration in a raise above the 600 level has opened a shoot of ore 5 ft. wide, of which 4 ft. is milling ore and 1 ft. is high-grade shipping ore. This shoot may be the one encountered on the 700 level, in which case the ore will be at least 250 ft. in known length and extend below the 700 level, where a station is being cut and sinking on the body will start soon.

The Old Dominion mine, from openings made in exploration, has shipped sixteen cars of ore since Sept. 30, which has netted the company, above freight and treatment, $59,000. Stoping operations have not begun, pending further exploration of the new orebody.

Copper Consolidation at Butte Would Exclude Anaconda

Since the Tuolumne Copper Co. has reported striking copper ore east of the main Continental fault at Butte, a persistent rumor has been circulated that several companies owning property in this part of the district are to consolidate. The companies mentioned are the East Butte, Tuolumne Copper, North Butte, Butte & London, and the Consolidated Mines. The latter company controls the Bullwacker and Butte-Duluth properties. These companies control a very large group of connecting claims and if merged into one company could do some very extensive and important development work at a depth of 2,000 ft. (the depth at which the Tuolumne made its recent strike) at a comparatively small cost. If ore in commercial quantity were opened they would have the advantage of owning the concentrator and smelter of the East Butte Copper Co.

Washington News

By Paul Wooton

Special Correspondent

House Committee Hears Debate on 14,589,730-Oz. Silver Purchase

Highly Technical Discussion—Senator Thomas Represents Silver Producers

Hearings are in progress, as this is written, before the Banking and Currency Committee of the House of Representatives in connection with the bill proposing the purchase of 14,589,730.13 additional ounces of silver under the Pittman Act. Representatives of the Treasury Department are appearing against the legislation; former Senator Thomas, of Colorado, is the chief witness for the bill.

The Treasury officials contend that they simply borrowed Pittman silver for the sake of convenience for the striking of certain urgently needed subsidiary coinage. The silver intended for that purpose, but which was not immediately available, subsequently was gathered together and used to replace the Pittman silver borrowed. Those favoring the legislation contend that advantage is being taken of a technicality to save the Treasury the difference between the market price of silver at the time and the price of $1 an ounce prescribed by the Pittman Act. Much of the hearing has been devoted to a technical debate as to just what constitutes a Treasury allocation of silver.

W. M. R. End in Sight

Motions for rehearings have been filed in so many of the War Minerals Relief claims that the work under this law bids fair to continue for several months more. Appeals in several of the more intricate cases are being contested, with the result that the commissioner continues to be kept very busy. Practically the entire staff, however, has been disbanded.

Unless the U. S. Supreme Court should hold that payments for property and for interest come within the act, the present appropriation will be sufficient to pay pending claims.

Urge Senators To Perpetuate Gold-Silver Inquiry

Judging from the large number of communications reaching members of the Senate, the mining industry in the West is doing all in its power to convince the members of that body that the work of the Commission of Gold and Silver Inquiry is appreciated and should be continued. Though most of the letters are coming from individuals, some civic associations and miners' organizations have taken formal action. Senator Shortridge, of California, brought to the attention of the Senate formal resolutions by the Northwest Mining Association, in which it is pointed out that "the work on behalf of the silver producers of the Pacific Northwest and of all parts of the United States has been of the utmost value," and as a consequence urges "that the researches and activities of the commission be further maintained." The resolution recites that the mining industry "recognizes and appreciates the value of the work."

Would Appropriate $90,000 for Oil-shale Development

The Senate has approved an amendment to the Interior Department appropriation bill allotting $90,000 "for the development of oil shale, including the construction of the necessary plant and the purchase, lease, or condemnation of the land necessary for the plant; for the purchase or mining of shale, the operation of the plant, and for all necessary incidental expenses." The probabilities seem to be that the House will accept this amendment.

Noranda Mines Finds More Copper-Gold Ore in Northwestern Quebec

Special Correspondence

A NEW discovery recently has been made on the Horne group of the Noranda Mines, in northwestern Quebec. The orebody lies 350 ft. east of No. 1 shaft and was found by a diamond-drill hole which showed 109 ft. of core equivalent to a horizontal width of 89½ ft., assaying $2.50 in gold and 2.3 per cent copper. Included in this is 48½ ft. horizontal width running $3.31 in gold and 3.26 per cent copper. The ore is disseminated and can be cheaply concentrated. The company has added to its holdings by acquiring the Timmins property, embracing 600 acres and adjoining the Noranda ground. Orders have been placed for another mining plant to duplicate that now in operation. This plant will be set up at No. 2 shaft, which was stopped at 79 ft. on account of the shortage of air. This shaft will be connected with the No. 1 shaft at the 110 level, on which most of the work is now being done.

It is understood that the Canadian National Railway is seriously considering the construction of a line south into the Rouyn field, and there is also a proposal that the Kirkland Lake branch of the T. & N. O. Ry., should be extended to meet the proposed Canadian National branch. If this were done it would ensure satisfactory railway facilities to this new district, and it is believed that the Noranda company is prepared to guarantee 5,000 tons of shipping ore a month for a period of two years.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Dome Prospects Brighten With Recent Developments

Opening of Large Orebody in Greenstones Is Significant — McIntyre Earned $421,637 in Quarter

Toronto, Jan. 17 — Recent developments at the Dome mine at Porcupine have been extremely encouraging, an orebody having been found a short time ago in the greenstones. This body has already been drifted on for 150 ft., with both faces in ore. The width varies from 4 to 35 ft. and the grade is understood to be above the general average of the mine, which is approximately $8.50 a ton. This development is of great significance, as it opens up substantial possibilities of further discoveries in the greenstone, under conditions similar to those in the Hollinger-McIntyre system.

Practically all of the Dome ore has been obtained from the sediments, so far, and the general feeling was that the possibilities of the greenstones were limited.

The quarterly report of the McIntyre Porcupine company for the three months ending Dec. 31 shows that earnings are being well maintained and are approximately twice the dividend requirements. For the quarter, gross recovery was $885,570, a decrease of $18,000 compared with the previous quarter. After making provision for taxes, but before plant depreciation, net earnings of the December quarter were $421,637, a decrease of $6,600. The issued capital of the company is $3,812,500, on which quarterly dividends of 5 per cent are being paid. At present the mill is treating about 33,000 tons a month, the tonnage being limited by the hoisting capacity. It is proposed to reopen the old Jupiter shaft, which will provide an additional 200 tons a day, bringing the tonnage up to 40,000 tons a month, which should result in production at the rate of $4,000,000 a year.

On the Coniaurum property, in Porcupine, controlled by the Coniagas Mines of Cobalt, a vein has been intercepted on the 1,000 level which shows free gold. This ore was first found by a diamond drill and has now been proven by the underground workings. It appears to be about 5 ft. wide, but sufficient work has not yet been done to determine widths or values.

The report of December operations of the Nipissing mine of Cobalt shows that during the month the company mined ore of an estimated net value of $197,640 and shipped bullion of an estimated net value of $273,799, silver being taken at 68½c. an ounce. Shaft 470, recently started to explore the conglomerate diabase area in the south center of the property, is down 50 ft. and will be continued to 300 ft.

Underground developments continue to be satisfactory, but there were no new discoveries. The low-grade mill treated 7,362 tons and the high-grade plant 89 tons. The total of the figures in the monthly report indicates the production for the year was valued at $2,063,388, compared with $2,353,309 in 1923. As the price of silver during the last year was considerably higher than during 1923, the production in ounces will show a considerable decline.

Johannesburg Letter

By John Watson

Special Correspondent

Bwana M'Kubwa Will Have £250,000 Fresh Capital

Nickel in Rustenburg District — Electrolytic Zinc Plant Being Erected in Northern Rhodesia

Johannesburg, Dec. 9—It is reported that the Anglo-American Corporation of South Africa and its associates have taken a block of more than one million new 5s. shares in the Bwana M'Kubwa Copper Mining Co. The company will be provided with £250,000 to £300,000 fresh capital, which should be ample to bring the Northern Rhodesia property to the producing stage within a year or so. It is hoped to treat, at first, 1,000 tons of ore per day, which should yield about forty tons of copper.

The ore reserves in the original mine, down to 500 ft., are estimated at more than 7,500,000 tons averaging 3.9 per cent copper. Further quantities are expected from the N'Kana mine, purchased early in 1924.

Reference was made recently to a discovery of nickel in the Rustenburg district of the Transvaal. Prospectors in that district consider there may be a good deal of nickel associated with small quantities of gold and larger proportions of copper. The production of nickel in the Union of South Africa started in 1921 with a value of £6,800 and in 1922 the value produced was equal to £13,165.

From Northern Rhodesia a *Star* correspondent reports that the mining industry is developing rapidly. Copper, zinc, and lead are the principal minerals and on a lesser scale gold and bismuth. A large plant for recovering zinc by the electrolytic process is being erected near the Belgian Congo border, and a big waterfall is being harnessed to provide the necessary power.

The Thabina correspondent of the *Star* says the Murchison range of mountains once more echoes with the clang of pegging. Antimony has risen in price and may go higher still. More than 2,000 claims have been pegged on the antimony belt, and further pegging is expected. The mineral production of the Union of South Africa for the month of October and for the first ten months of this year has been:

	October	Total for 10 months
Gold (at standard rate)	£3,500,746	£33,779,278
Gold premium	290,321	3,540,252
Silver	20,962	176,908
Osmiridium	9,885	68,509
Diamonds	786,665	6,812,346
Coal	341,839	3,192,074
Copper ore and concentrates	65,957	431,159
Tin concentrates and metallic	28,961	254,934
Other minerals	28,491	245,641
Totals	£5,073,827	£48,501,101

London Letter

By W. A. Doman

Special Correspondent

Lustre of "M.I.M.M." Seems to Have Dimmed

Magic Letters Shield Mediocrity Instead of Guaranteeing Ability—Institution Urged to Act

London, Jan. 7.—Considerable discussion is taking place concerning the Porcupine-Davidson affair. Various aspects of the matter having been criticised here, Charles McCrea, Minister of Mines for Ontario, was invited by the *Financial News* to express his views. He has now replied, and his statement is regarded as much to the point. He says that the government is not a court of law and has not authority or power to apply a remedy. The transaction was entirely between private parties. The remark which is creating the greatest interest is that five engineers have reported and a sixth might add his weight to one side or the other, but would not settle the matter. Such a report would have absolutely no effect upon the rights of the disputants, upon which only the courts of law can pronounce.

The feeling among leading technical men is that the honor of the profession, or the status of some of its members, is in question. One prominent engineer remarked to me that if only a really well-known and trustworthy and outspoken engineer had been engaged at first, the trouble might not have arisen. His view is that for reasons of economy, or rather as a cheeseparing policy, neither sufficient time nor sufficient money was allowed for the examination. It is not sound finance to deal with such matters in a half-hearted manner, and it has been suggested that the Institution of Mining and Metallurgy should express its views officially. Clearly something is wrong. At one time the letters of M.I.M.M. after a name were accepted as the standard of ability. Has this standard been lowered?

It had generally been expected that when Sir Robert Horne went to Burma he would become a director of the Burma Corporation. This expectation has proved correct. He is chairman of the National Smelting Co., and presumably represents its interests on the Burma board. Other directors appointed are Sir Henry Strakosch, managing director of the Union Corporation; F. A. Govett, of the Lake View Investment Trust; A. Chester Beatty, who represents financial interests; and Sir Cecil Budd, joint managing director of the British Metals Corporation.

W. R. Feltmann has just returned from the Ashanti Goldfields, of which he is the consulting engineer.

The directors of the Rhodesian Congo Border Concessions have issued a report upon the discoveries, written by P. K. Horner, consulting engineer. Mr. Horner states that the Concession embraces an area of 52,000 square miles, and that two deposits, the N'Changa and the Eastern, have been found worthy of immediate work to prove the existence of commercial orebodies.

At N'Changa the sulphide zone begins at a depth of about 200 ft., and it is estimated that between 500,000 and 600,000 tons of ore may be expected for each 100 ft. of depth. The report refers to promising properties in different districts, although definite conclusions cannot yet be arrived at as to extent and value. It may be mentioned, however, that in the southern area preliminary sampling shows from 0.8 per cent to 11.5 per cent copper.

Considerable excitement has been witnessed in the land share market in London on receipt of cable dispatches from South Africa reporting discoveries of platinum in the Lydenburg district of the Transvaal. The Central Mining & Investment Corporation and the South Africa Townships are jointly prospecting the finds made on the property of the Transvaal Consolidated Lands, and much interest is also taken in the areas held by the Transvaal Estates and Development.

The fire in the Central Mine of the Sulphide Corporation at Broken Hill (N.S.W.) has already cost the company about £200,000, besides preventing operations from being carried on. The worst is now said to be over. The chairman, the Earl of Kintore, stated at the shareholders' meeting, that for the next six months it is planned to treat at the company's own mill weekly 500 tons of Central slimes, together with such crude ore of payable grade as can be obtained from the Junction mine, and later on from the Central mine, and at the same time to treat a further 500 tons weekly of Central slimes at the Broken Hill Proprietary Co.'s mill.

Miami Employee-Customers Get 17.16 per Cent Rebate on Bills

THE Miami Commercial Co., a co-operative department store operated by the Miami Copper Co., is disbursing to those of its employees who are entitled to participate, the sum of $53,444.42, which represents the profits of the store for the last half of 1924. The rebate paid to each employee will amount to 17.16 per cent of the total of his purchases for the period.

Will Develop 42,500 Hp. in Clifton-Morenci District

New sources of hydro-electric power for Arizona's mining and other industries are soon to be tapped in the vicinity of the Clifton-Morenci district. The Commonwealth Light & Power Co., backed by Chicago and Detroit capital, has started preliminary work on the construction of a dam on the west fork of the Black River. Actual construction work on the dam, is expected to require six months' time. This project will furnish around 30,000 hp.; and a second unit, to be constructed on the San Francisco River near Clifton, will furnish 12,500 hp. The estimated cost of the project is $4,500,000.

Chronology—1924

January

Jan. 12—Reported proposal that Department of Commerce be expanded to include mining, its designation to be the Department of Commerce and Mining—as a temporary alternative to the proposal that a new Cabinet portfolio be created, providing for a Secretary of Mines.

Jan. 12—Publication of report by H. Foster Bain and H. S. Mulliken, U. S. Bureau of Mines, in which it is indicated that caliche reserves in Chile are sufficient for several generations.

Jan. 12—Imminent collapse of Copper Export Association foreshadowed.

Jan. 19—Tin famine predicted by a specialist.

Jan. 22—Safety Conference meets in New York.

Jan. 26—Merger of Ray Consolidated and Chino Copper companies progresses to stage at which approval of stockholders only is needed.

Jan. 30—R. B. Watson, well known in Canadian and American mining circles, died at Cobalt, Ont., Canada.

February

Feb. 2—Directors of Davis-Daly Copper Co. recommend to stockholders the sale of property at Butte, Mont., to Anaconda company.

Feb. 2—Reported that A.I.M.E. withdraws from American Engineering Council.

Feb. 2—C. W. Merrill awarded Douglas medal for contributions to science of cyaniding.

Feb. 9—President of Calumet & Arizona company advocates tariff on copper.

Feb. 9—Commission of Gold and Silver Inquiry issues progress report.

Feb. 10—Progress report denotes encouraging developments in platinum mining in Transvaal.

Feb. 10—Edwin Ludlow, president of A.I.M.E., 1921-22, died at Muskogee, Okla.

Feb. 18—A.I.M.E meets at New York. William Kelly becomes president. Society of Economic Geologists meets jointly with A.I.M.E.

Feb. 23—Atolia tungsten mine in California reopens.

Feb. 23—Senate committee increases appropriations for U. S. Bureau of Mines and U. S. Geological Survey.

Feb. 25—Transvaal gold output for February reported as 796,768 oz.—almost a record.

Feb. 29—Senate Committee on Mines and Mining reports favorably on Mineral Appropriation Bill.

March

Mar. 2—Gustav Setz, metallurgist, died at St. Louis.

Mar. 4—President Obregon of Mexico establishes new mine law.

Mar. 5—Canadian Institute of Mining and Metallurgy meets at Toronto.

Mar. 8—J. D. Matheson died at Salt Lake City.

Mar. 11—Copper smelting in New Guinea makes little progress, according to reports.

Mar. 22—Encouraging reports of lead discoveries at Cloncurry, Queensland.

Mar. 22—New Magma copper smelter blown in at Superior, Ariz.

Mar. 22—Reported incorporation of Belgian corporation for purpose of purchase of entire output of Mexican zinc mines.

Mar. 26—Merger of Randfontein Estates and Randfontein Central presaged.

Mar. 29—Report current that Eagle-Picher has purchased holdings of Interstate Lead & Zinc Corporation for $600,000.

April

April 1—Edwards mine of New York Zinc Co. flooded.

April 1—Federal Mining & Smelting Co. closes option on Moses-Childress interests in Joplin-Miami district.

April 5—Death reported of Sir George Doolette, well known in mining circles in the city of London.

April 6—Fire breaks out in Sacramento mine, Bisbee.

April 17—Reports from Melbourne indicate that gold placers in New Guinea are of little value.

April 27—Record blast at Corona, Calif., loosens 2,000,000 tons of rock.

April 28—American Zinc Institute meets at St. Louis and elects A. E. Bendelari president.

April 28—H. O. Hofman, professor of metallurgy at the Massachusetts Institute of Technology, died at Cambridge, Mass.

May

May 3—Mining companies at Bingham, Utah, and the Utah Copper Co. have joined smelters in raising wages 25c. per day.

May 3—Life of Chilean Nitrate Producers Association extended for six years.

May 3—Reported that Calumet & Hecla Consolidated now holds record for mine nearest to center of earth—5,990 ft., vertical; 4,600 ft. below sea level.

May 3—Record in shaft sinking made by Verde Central Copper Co. employees, at Jerome, Ariz.—856 ft., three-compartment, the work being done in ninety days.

May 10—President of Asbestos Corporation of Canada advocates goverment action to save industry.

May 10—Efforts being made at Washington to terminate work of Commission of Gold and Silver Inquiry on the ground of unnecessary expense.

May 10—Announced that United Comstock makes profit for first half of year.

May 12—Chestatee Pyrites & Chemical Corporation wins War Minerals Relief suit.

May 16—Prince Gelasio Caetani makes commencement address at Colorado School of Mines.

May 17—Reported that large copper shipments in April reduced surplus by 18,000,000 lb.

May 19—Labor troubles reported from the Witwatersrand, South Africa.

May 24—Bill for tariff on copper introduced in House of Representatives.

May 31—Senate Committee on Agriculture approves an appropriation of $5,500,000 for exploration work in search of potash.

May 31—Ohio Copper expects to be able to produce for 5.75c. per pound.

June

June 3—Mining and Metallurgical Congress held at Empire Mining and Metallurgical Exposition at Wembley, London.

June 10 — California Gold Producers confer at Grass Valley, Calif.

June 14—Reported that Chilean tin interests are merged into influential corporation.

June 15—Death announced of H. M. Swetland, technical publisher, at Upper Montclair, N. J.

June 15—C. F. Sturtevant, mining engineer, murdered in Mexico.

June 21—Nipissing company uses air route for transport of men and supplies to mining district in Ontario.

June 25—Society for the Promotion of Engineering Education meets at Boulder, Colo.

June 27—Ivanhoe Gold and Lake View & Star, Western Australian companies, reach agreement prior to co-operative effort.

June 30—F. W. McNair, president of Michigan College of Mines, killed in train wreck at Buda, Ill.

July

July 1—Suspension of operations of Tharsis Sulphur & Copper Co. reported.

July 2—C. R. Corning died in France.

July 5—Columbia University modifies entrance requirements.

July 5—Polish Government buys 3,200,000 oz. silver in the United States, to be minted into zlotys.

July 12—U. S. Steel and Aluminum Ore companies purchase fluorspar mines in Middle West.

July 13—Oscar Newhouse died in New York.

July 14—New gold reef discovered in Mysore mine, India.

July 21—Diamond rush reported from the Transvaal, South Africa.

July 26—British-America Nickel Corporation goes into voluntary liquidation.

August

Aug. 2—Ohio Copper makes low record in production cost—5.3143c. per pound.

Aug. 6—British Association for the Advancement of Science meets at Toronto, Canada.

Aug. 7—Senate Committee on Banking and Currency favors Silver Purchase Bill. Senate passes bill.

Aug. 9—Rand gold output for July second best in history of field.

Aug. 9 — Federal Trade Commission comments favorably on formation of Silver Export Association.

Aug. 10 — J. J. Stevenson, professor emeritus of geology at New York University, died.

Aug. 16—American Silver Producers' Association organized.

Aug. 16 — Reserves of four billion yards of profitable placer gravel in California estimated by Bureau engineer.

Aug 16—Argentine Government wants H. F. Bain, director of the U. S. Bureau of Mines, to survey iron resources of the republic.

September

Sept. 6—New corporation, headed by National Lead Co., takes over Llallagua and Unica tin mines in Bolivia.

Sept. 6—C. Leonard Ball is appointed director general of mines by Bolivian Government.

Sept. 15—Analysis shows recent rise in wages to white employees on Witwatersrand.

Sept. 18 — George Walker, discoverer of the Witwatersrand gold field in 1886, died at Krugersdorp, Transvaal.

Sept. 21—Franklin Institute celebrates centenary.

Sept. 29—Disastrous fire, the second in fifteen months, destroys Goldfield, Nev.

Sept. 29—American Mining Congress meets at Sacramento.

October

Oct. 4 — Investigation of copper industry promised by Federal Trade Commission.

Oct. 4—Dividends distributed to date by the Premier mine, British Columbia, exceed $6,000,000.

Oct. 4—James H. Fahy, original locator of molybdenum in America, killed in automobile accident near Red River, N. M.

Oct. 7—Union Minière plans further expansion of operations at Katanga, Belgian Congo.

Oct. 8—E. N. Breitung died in New York.

Oct. 8—American phosphate interests appeal to government in effort to counteract Franco-German accord in Moroccan phosphate production.

Oct. 10—National Safety Conference meets at Louisville, Ky.

Oct. 10 — Bandits murder American mine auditor and train crew near Candelaria, Mexico.

Oct. 11 — Federal Trade Commission declares that aluminum industry is monopolized by Aluminum Company of America.

Oct. 14—Twenty-year contract signed whereby A. S. & R. will operate Victorio properties in San Luis Potosí district, Mexico.

Oct. 19—Charles Fergie, past president of the Canadian Mining Institute, died.

Oct. 25—Control of Patiño tin properties in Bolivia by National Lead Co. denied.

Oct. 28 — Activity in Tanganyika shares ascribed to American copper interests.

Oct. 29—H. A. Lee, formerly superintendent of the Silver King Consolidated, Park City, Utah, died at Salt Lake City.

Oct. 29—D. A. Dunlap, vice-president and treasurer of the Hollinger company, died at Toronto.

November

Nov. 1—Anaconda company resumes operations at Pennsylvania mine, Butte.

Nov. 3—Cornelius Cole died at Los Angeles.

Nov. 8 — Phelps Dodge Corporation denies rumors that it expects to sell copper mining properties in Arizona and New Mexico.

Nov. 15—Construction of new plants in Mexico by A. S. & R., involving expenditure of $10,000,000, announced.

Nov. 17—Aluminum Company of America buys fluorspar mines in Illinois and Kentucky.

Nov. 22—Merger of Inspiration and Ray Consolidated copper companies predicted.

Nov. 22—A. H. Brooks, geologist, died at Washington, D. C.

Nov. 24—Plant and property of United Comstock Mines Co., Virginia City, Nev., sold to subsidiaries of Consolidated Goldfield of South Africa.

Nov. 26—Announced that H. F. Bain, director of the U. S. Bureau of Mines, will survey iron-ore resources or Argentina.

Nov. 29 — Provincial Government of Ontario announces payment of bounty on iron ore produced in the province.

Nov. 30 — Old Dominion smelter at Globe, Ariz., shut down permanently.

December

Dec. 1—Northwest Mining Convention held in Spokane, Wash.

Dec. 6—Ford Motor Co. purchases lead mine in Idaho.

Dec. 10—Bunker Hill & Sullivan Mining & Concentrating Co. increases its capitalization by $2,000,000.

Dec. 13—New oreshoot discovered in Hecla mine at Burke, Idaho. Hercules mine, at Burke, Idaho, stops production.

Dec. 22—Anaconda announces plan for financing Andes Copper Mining Co.

Dec. 20 — Chief Consolidated of Eureka, Utah, increases its capitalization by 500,000 shares.

Dec. 27—Comstock Merger of Virginia City, Nev., issues $1,500,000 bonds.

Men You Should Know About

W. A. Carlyle, mining engineer, now residing at Victoria, B. C., will spend the summer in Italy.

George W. P. Hunt on Jan. 5 took the oath of office as Governor of Arizona for the fifth term.

Frank G. Stevens, mining engineer of Toronto, is making examinations in the State of Jalisco, Mexico.

Clifford G. Dennis, mining engineer, of San Francisco, has been examining mines in southeastern Arizona.

Sydney H. Ball, mining geologist, of Rogers, Mayer & Ball, has returned from an investigation in Canada.

General John C. Greenway gave a housewarming party at his new home at Ajo, Ariz., on New Year's night; 1,500 persons attended.

Prince Gelasio Caetani, who is about to return to Italy, made an address on Jan. 17 to the Italian Chamber of Commerce of New York City.

R. S. Botsford, mining engineer of New York, was in Cobalt, Ontario, last week on professional business, and in Toronto during the week ended Jan. 24.

James MacNaughton, general manager of the Calumet & Hecla Consolidated Mining Co., in the Michigan copper district, is in New York on business.

Arthur Winslow, president and general manager of the Liberty Bell Gold Mining Co., recently arrived at San Francisco on his return from Hawaii to Boston.

W. H. Schacht, general manager of the Copper Range company in the Michigan copper district, has returned to Michigan from a business trip to New York.

Charles Adrian Burdick, mining and metallurgical engineer, of New York, was married in that city on Jan. 15 to Miss Florence Mary Hicks, also of New York.

Frederick G. Clapp, consulting geological engineer, has left Australia and gone to New Zealand as consulting geologist for Melbourne and Sydney mining interests.

George A. Brockington has been elected secretary of the American Smelting & Refining Co. He succeeds **W. E. Merris,** who is retiring because of age limitations.

Harris K. Masters has been appointed by the board of managers to be acting secretary of the New York Metal Exchange and **James J. Murphy** has been made assistant secretary.

William L. Honnold, Edward Higgins, president of the California Metal Producers' Association, and **L. D. Davenport** addressed the January meeting of the San Francisco section of the A.I.M.E.

George W. Farnham, who has for a number of years called on college professors for the McGraw-Hill Book Co., New York, has been made manager of the educational department of that company.

John A. Burgess, mining engineer and geologist, of San Francisco, is on his way to Venezuela. He expects to return to the United States the latter part of February, when he will be in New York for a short period.

George J. Young, associate editor, *Mining Journal-Press,* who had been in New York since Nov. 15 last, in charge of the Fifty-sixth Annual Review and Year Book of *Mining Journal-Press,* has returned to his San Francisco headquarters.

C. F. Kelley

C. F. Kelley, president of the Anaconda Copper Mining Co., has gone to South America to visit the Anaconda properties there. He is accompanied by Mrs. Kelley and his three eldest daughters. According to present plans he will return on March 10.

Arthur Notman, mining engineer and geologist, has joined the staff of H. T. Carey & Co., members of the New York Stock Exchange. Mr. Notman will act in an advisory capacity, with especial reference to the securities of copper-mining companies.

Arthur Clark Terrill, for the last four years professor of mining engineering at Pei Yang University, Tientsin, China, has returned to his home in Glendale, Calif. He is now lecturer in geology at the California Institute of Technology, at Pasadena.

C. Flury has resigned as chemical engineer and mill superintendent of the Chosen Syndicate, Ltd., operating the French mining concession in Korea, to become superintendent-engineer of the Goenoeng Malajoe Estate, in Sumatra, East Indies.

Obituary

James Wilmer Beard, who for more than twenty years was auditor and comptroller of the International Nickel Co., and who died on Jan. 1 while on his way to England, was honored with memorial services at the Church of the Transfiguration, in New York, on the afternoon of Jan. 13.

Clare St. George Yarwood died at Sumas, British Columbia, on Jan. 5. At the beginning of the Klondyke rush, Mr. Yarwood was sent to Dawson by the Canadian Bank of Commerce to start a branch office there. He is credited with having sent the first consignment of gold from Dawson to Seattle.

Ralph C. Richards, one of the organizers and fifth president of the National Safety Council, died at his home in Geneva, Ill., recently after a long illness. Mr. Richards was sixty-nine years old. Funeral services, conducted at the Richards home in Geneva, were attended by 400 relatives, friends and associates from all parts of the country.

Captain Cony T. Brown

Captain Cony T. Brown died at his home in Socorro, N. M., on Jan. 15, 1925, at the age of sixty-eight. Captain Brown was born in Maine. With the true pioneer spirit of the New England settlers, he went to New Mexico in 1881 and settled in Socorro, and with enthusiasm assisted in the development of the country. He never lost his interest in this work. He was a man of the finest principles and character. With a broad mind, there was scarcely a field of activity in which he did not play an important part. In mining, agriculture, cattle raising, irrigation, building of towns, industries, schools and state work—in fact, wherever he could be useful—he was active to the last. His keenest interest, however, was in mining and the development of natural resources. Without technical education in his youth, he learned at every opportunity. Captain Brown accumulated a unique and valuable library and geological and mineralogical collection of specimens. This was not for a plaything, but was used and industriously studied. Though his principal work was in the Magdalena Mountains, yet it was spread out to cover the Southwest and northern Mexico, with occasional exploration in British Columbia, and Central and South America. About ten days before his death he returned from Kingston, N. M., suffering with a severe cold, but he was making preparations to go to Santa Fe, where he was a member of the new Legislature. One of his enduring monuments will be the School of Mines at Socorro. It was due largely to his efforts that the school was started and maintained. He was one of the governors of the school and devoted a great deal of time to making it a success. To Captain Brown the country owes a great debt for his work in developing the great resources of the Southwest. Only those who experienced the conditions at the time he went to New Mexico can realize the value of his efforts; not only due to the physical condition of the country and the fact that it was peopled by Mexicans, but also to the fact that the Apache Indians were still on the warpath in these early days. Personally, Captain Brown was a lovable character, with a broad sympathy for humanity and a desire to help. Not only students at the School of Mines but all young men who came in contact with him realized the inspiration that he imparted to them and the amount of work that he was always ready to give to aid them. To all who knew him the loss is a personal one and his example is an inspiration. ARTHUR THACHER.

Societies, Addresses, and Reports

Engineering Council Praised by Secretary Hoover

Has Done More For Public Welfare Than National Societies in Whole Period of Their Existence

A tribute to American Engineering Council was paid by Secretary of Commerce Hoover at the council's annual dinner at the Chevy Chase Club in Washington, D. C., on Jan. 16.

The province of the government in the conduct of its scientific services, Mr. Hoover said, in the conduct of many of its activities which make directly for an increment of national wealth, had only been touched upon in public welfare. Engineering Council's first large activity in research was in the subject of "Waste." For the first time it was brought to the attention of engineers, scientists, and the public that something was wrong in our economic system.

The Department of Commerce took up the work of making effective the possible accomplishment outlined by that investigation, and since then it had actually spent about $100,000 a year in that work. Today, said Mr. Hoover, the reduction in waste in our economic system exceeded $600,000,000 per annum, a result of following the original report of the conference.

The establishment of standards, the economies which they bring in production and distribution; the elimination of unnecessary varieties, the establishment of specifications, the vast improvement in statistical services and the stability they give to business, had all of them contributed amounts estimated by those who are engaged in industry to far exceed the figures given above.

Were it possible, the Secretary continued, to recruit money by public subscription for the expense and continuation of that work there would be no difficulty in raising from one to five million dollars per annum from the trades themselves, so much did they appreciate the possibility of a government service of a reproductive character.

It was through the elimination of waste and the increase in national efficiency that we could hope to reduce the cost of living and to increase the standards of living, said Mr. Hoover. There was no panacea for all economic troubles, but the elimination of waste was in itself an asset and not a liability.

Mr. Hoover said that it was a tribute to American Engineering Council that it should have launched a campaign five years ago that had come to have such a general respect throughout industry that the Department of Commerce was asking industries to delay their conferences and their programs for three or four months ahead so that its representatives might attend them.

Those who had worked in the council had realized the difficulty of keeping it alive, but if all engineers who had not yet come to the council's support could be brought to realize that in accomplishment this council had done more for public welfare than engineering societies in the whole period of their existence the council might indeed gain some strength that it so badly needed in its immediate support in Washington.

"I trust that the American Engineering Council may go on and gain in strength," said Mr. Hoover in concluding. "I am in hopes that the reorganization which you undertook a year ago will make it possible for some of our engineering brothers to come more amiably into line; it may be we will have to wait for the death of some of the older members of some of the societies, but we can at least live in hopes, and in the meantime we must keep the council alive, for if the institution can go on and if it can produce not once in five years but once in fifty years the beginning of a great national conception in the change in our economic system such as was produced five years ago, it will warrant its existence and all of the labor which you gentlemen have devoted to it."

Ceramic Society Will Meet in February

The annual meeting of the American Ceramic Society will be held at Ohio State University Feb. 16-21 in connection with the national celebration of the thirtieth anniversary of the beginning of ceramic education in America. An exhibit of equipment and materials will be shown in Lord Hall. Ceramic manufacturers will display their products in the new museum building of the Ohio Historical and Archaeological Association.

The university has invited all other universities having ceramic departments to participate in the celebration. Ceramic trade associations will send delegates. Ohio manufacturers are planning plant itineraries for each of the divisions which will profit all who will participate.

Stevens Awarded John Fritz Gold Medal

Award of the John Fritz Gold Medal to John F. Stevens, of New York City, for great achievements as a civil engineer, particularly in planning and organizing for the construction of the Panama Canal; as a builder of railroads, and as administrator of the Chinese Eastern Railway," has been announced by the Engineering Foundation.

New Equipment for Stanford

An oil-testing laboratory and an oil sedimentation laboratory have been built in the mining building at Stanford University under direction of Prof. Frederick G. Tickell. Construction was completed during the early part of January.

A.I.M.E. Announces Program for Annual Meeting

To Be Held in New York, Feb. 16-19—Unusual Arrangements Made For Smoker This Year

As varied and interesting a program as is usually provided has been announced, tentatively, for the 131st meeting of the American Institute of Mining and Metallurgical Engineers. The meeting is to be held in New York, as is customary. Topics for the consideration of which separate sessions have been arranged are as follows: Coal; ground movement and subsidence; non-metallic minerals; iron and steel; petroleum; mining methods; milling methods; non-ferrous metallurgy; industrial relations. The Institute of Metals Division will have its own sessions on Monday morning and afternoon, and also on Tuesday afternoon, when the annual lecture will be given. The Howe Memorial Lecture will be delivered on Monday afternoon by Dr. John A. Matthews, vice-president of the Crucible Steel Co. of America.

An event of the meeting will be the unveiling of a life-size bronze tablet of Dr. Rossiter W. Raymond, a photograph of which was shown on the cover of *Mining Journal-Press* of Jan. 10, 1925. This ceremony will take place on Monday at 5 p.m. in the Entrance Hall of the Engineering Societies Building at 29 West 39th St., where the meeting will be held.

Unusual arrangements have been made this year for the annual smoker, which is to take place at the Café Savarin. Professional entertainment will be provided.

The annual business meeting will be Tuesday morning. Reports for the year will be presented and officers elected for 1925.

Among the papers to be presented are the following:

Ground Movement and Subsidence

Monday, 9.30 a.m.

"Factors Affecting Bank Slopes in Steam-shovel Operations." Louis S. Cates, vice-president and general manager, Utah Copper Co., Salt Lake City, Utah.

"Mine Support and Mine Subsidence in the Birmingham District," W. R. Crane, Superintendent Southern Mining Experiment Station, Birmingham, Ala.

"Rock Bursts and Bumps." George S. Rice, Chief Mining Engineer, Bureau of Mines, Washington, D. C.

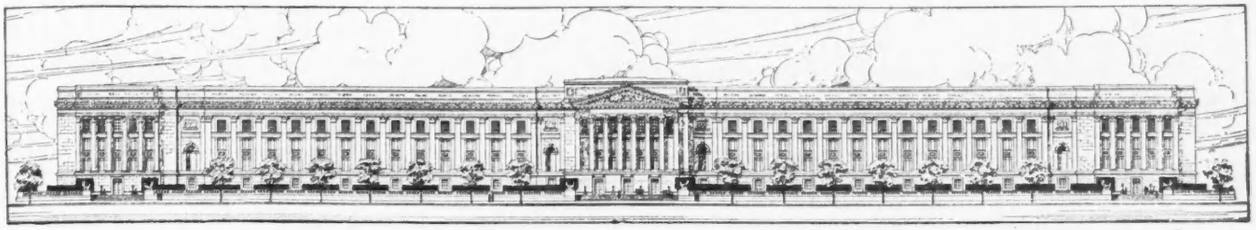
Non-Metallic Minerals

Monday, 9.30 a.m.

"Limestone Production as a Mining Problem." J. R. Thoenen, Greenville, Ohio.

"Engineering in Limestone Production." C. C. Griggs, Engineering Division, Internal Revenue Bureau, Washington, D. C.

"Rotary Calciners for Gypsum." Frank A. Wilder, president and manager, Southern Gypsum Co., North Holston, Va.



The proposed National Museum of Engineering and Industry, to be erected in Washington, D. C.

"Phosphate Deposits of Idaho and Their Relation to the World Supplies." Virgil R. D. Kirkham, Idaho Bureau of Mines and Geology, Moscow, Idaho.

Mining Methods

Tuesday, 10.30 p.m.

"Methods of Mining and Ore Estimation at Lucky Tiger Mine, Sonora, Mexico." R. T. Mishler and L. R. Budrow, vice-president and general manager, Douglas, Ariz.

"Mining Methods of Jarbidge District, Nevada." John Park, Jarbidge, Nev.

"Mining Operations at Cornucopia, Ore." Robert M. Betts, Cornucopia, Ore.

"Properties of Liquid Oxygen Explosives." G. St. J. Perrott, Bureau of Mines, Pittsburgh, Pa.

"Mining Methods at the Homestake." A. J. Ross, Lead, S. D., and R. G. Wayland, Lead, S. D.

"Mining Methods in Zaruna District, Ecuador." Rudolph Emmel, South American Development Co., Guayaquil, Ecuador.

Milling Methods

Wednesday, 2 p.m.

"Recent Developments in Fine Grinding and Treatment of Witwatersrand Ores." Carl R. Davis, J. L. Wille and S. E. T. Ewing, all of Anglo-American Corporation of South Africa, Johannesburg.

"Determination of Dissolved Oxygen in Cyanide Solutions." A. J. Weinig, Director of Experimental Plant, Colorado School of Mines, Golden, Colo., and Max W. Bowen, Golden, Colo.

"Precipitation Efficiency of Zinc Dust." Robert Lepsoe, Bergen, Norway.

Non-Ferrous Metallurgy

Wednesday, 2 p.m.

"Redistillation of Zinc." Kurt Stock, Fish Creek, Wyo.

"High Zinc and Lead Blast Furnace Slags." Fred E. Beasley, Kellogg, Idaho.

"A New Roasting Furnace for Zinc Flotation Concentrates." Charles H. Fulton, Director, Missouri School of Mines and Metallurgy, Rolla, Mo., and J. Burns Read, Denver, Colo.

"The Coolbaugh Process." M. F. Coolbaugh and J. Burns Read.

"Application of Pulverized Coal to Copper Refinery Furnaces." E. W. Steele, New York.

"Recovery of Arsenic and Other Valuable Constituents from Speiss." C. P. Linville.

The annual reception and banquet will be held at the Waldorf-Astoria Hotel on Wednesday evening.

Metal Men Organize New York Club

Will Furnish Place for Social and Business Activities—Success of Venture Assured

A lunch club is being organized in New York City by men in the metal trades. It is proposed to move the New York Metal Exchange from its present quarters to the new club at 27 William St., where space is available not only to accommodate the requirements of the Metal Exchange but also the needs of the club. The appointments and equipment of the club will be of the best. Its central location right in the heart of the downtown business district promises to make the club a convenient place for taking the noonday meal.

Aside from its social advantages, the club is intended to serve as a meeting place and headquarters for the iron and steel and non-ferrous metal and the rubber and cotton trades, importers and exporters, bankers and brokers, insurance, commission and shipping interests, and business and professional men in general. The club will provide a meeting place where metal men may become better acquainted with one another. It is a well-known fact that metal business is transacted daily between parties who know one another by name, but who have never had the opportunity of meeting and becoming acquainted.

The following are the names of a few of the prospective members of the club affiliated with the metal trades: Clinton H. Crane and Irwin H. Cornell, St. Joseph Lead Co.; E. J. Cornish, A. B. Hall, H. S. Warshow, J. R. Wettstein, N. B. Gregg, G. W. Thompson, National Lead Co.; J. B. Beaty and M. H. Merriss, Nichols Copper Co.; C. M. Loeb, H. K. Hochschild, Julius Loeb, L. Vogelstein, Heath Steele, E. H. Hothorn, J. H. Lang, L. Vogelstein, American Metal Co.; V. C. Leftwich, A. S. & R. Co.; A. W. Dodd, American Zinc, Lead & Smelting Co.; K. C. Li, Wah Chang Trading Corporation; Harris K. Masters, New York Metal Exchange; C. S. Trench, C. S. J. Trench and Stewart Trench, C. S. Trench & Co.; E. Benjamin, Brandeis, Goldschmidt & Co.; Henry Greve, John Wahl Commission Co.; B. Elkan, International Minerals & Metals Co.; W. Homer Hendricks, New Jersey Zinc Co.; Parker D. Handy and C. W. Handy, Handy & Harman; D. M. Rosenthal and John C. Ryan, United Metals Selling Co.; B. Lissberger, Federated Metals Co.; Ralph B. Williams, Metal & Thermit Corporation, and W. D. Balmain, American Brass Co.

An Addition to Washington's Public Buildings

In the accompanying cut is shown an architect's drawing of the $5,000,000 National Museum of Engineering and Industry, to be erected in Washington, D. C., on the Smithsonian Institution grounds on the Mall as a companion building to the natural history museum and the gallery of the fine arts, the classic structures erected in harmony with the new plans of the Fine Arts Commission, designed to make Washington the world's most beautiful capital city. The new museum will house exhibits depicting the dramatic evolution of engineering and the industries and will be the first national institution in this country devoted exclusively to recording industrial progress. It will be 1,150 ft. long, 250 ft. deep and cover twenty-seven acres of floor space. The great central rotunda will house a Hall of Fame for eminent engineers, inventors, and industrialists.

A public building and endowment fund of $10,000,000 is being raised from the present headquarters of the National Museum of Engineering and Industry in the Engineering Societies Building, 29 West 39th St., New York City.

Catlin Heads M.M.S.A.

The Mining and Metallurgical Society of America held its annual dinner and meeting at the Harvard Club in New York on Tuesday evening, Jan. 13. The announcement of election of officers was made. R. M. Catlin was chosen as the president for 1925, S. H. Ball, vice-president, and Donald M. Liddell, secretary. The presidential address of the retiring president, Thomas H. Leggett, was on the subject of the ethics of the mining industry. He traced the history of the inquiries made into this subject by the society, gave at some length his own view on the question, and recommended further consideration and action by the society. The new president, Mr. Catlin, was then introduced by his lifelong friend and associate, Fred Hellman; he spoke at some length of past, present, and future conditions in industry, expressing the belief that the great changes we have seen are only the beginning of those which are evolving around us with great swiftness.

A pleasing feature of the evening was the showing of motion pictures illustrating the use of centrifugal force in the new process of casting iron pipe, these pictures being shown by John A. Capron, research engineer. The Gold Medallist was not announced, the matter being still under advisement.

Recent Technical Publications

Reviews, Abstracts, and References

The Mines Handbook Out at Last

The Mines Handbook. Vol. XVI. By Walter Harvey Weed. The Mines Handbook Co., Tuckahoe, N. Y. Price $15.

After having been promised for publication from month to month ever since last summer, "The Mines Handbook" at last appears, with "1925" printed on the cover, title, and preface pages, and "1924" at the top of its other 2,348 pages. We have admitted before that this book is used more than any other in the *Mining Journal-Press* office, for it is the most complete directory obtainable of American mines and prospects, their organization, development, equipment, and operating results. It is also as accurate and up to date as any reasonable man could expect who knows the vast difficulties in preparing such a book. Mr. Weed says in his preface that the long delay in publication (it has been two and a half years since the last volume appeared) has been caused by the necessity of writing a new book rather than revising the old one, and we do not doubt that this statement is practically true. The old data had to be checked, even if not rewritten in all instances. The work has been well done.

In this volume, reference is made only to American companies; and by American we mean, as is proper, those of the Western Hemisphere. Heretofore some of the more important companies of other continents have been included, but the information has been too scattering to be of much use, so that it is just as well to omit it. A separate volume could well be devoted to mining companies in other countries, for no book covers the subject satisfactorily at present.

Most of the data that Mr. Weed presents have been obtained from original sources, but a few references are made to more complete data in published articles, and a few excerpts are given, occasionally, we regret to say, without credit, as on page 1970. Some general statements are made, which appear to be unprejudiced, as to the standing and prospects for success of certain companies. That Mr. Weed is not without a spark of humor, even in a serious book like this, is evidenced by his reprint, in full, of a yarn from our columns about the ablutions of a group of Broadway stenographers at an Arizona mine.

E. H. Robie.

The Colcord Lead Refining Process

U. S. Patent No. 1,523,980, issued to Frank F. Colcord, and assigned to United States Smelting Refining & Mining Co., may work a considerable change in the Parkes process for refining lead bullion. Present practice is to remove a portion of the copper in lead bullion in the softener, the remainder being removed with the zinc-silver crusts, increasing thereby the zinc consumption. Arsenic is eliminated in the softener and appears afterward in antimonial lead and in flue or baghouse dust. The patent mentioned removes copper and arsenic from the bullion cheaply and quickly as the first operation in refining. The process is not necessarily confined to lead bullion, but can be applied equally as well to antimonial lead, which is always a product of the Parkes process.

The process seems comparatively simple, consisting of stirring sulphur into the metal, preferably with a Howard stirrer, at a temperature sufficient to cause the sulphur to unite with the copper, and then raising the temperature of the metal until the copper sulphide formed readily separates as a dross from the metal. The recommended initial temperature is from 600 to 650 deg. F. and the final drossing operation should be performed at about 700 deg. F., both temperatures depending on the alloys. A thirty- or forty-ton kettle can be decopperized readily in about forty-five minutes. The next step in the process is to add caustic soda to the metal, raise the temperature to between 900 and 1,000 deg. F. and thoroughly stir the caustic soda into the metal, which may be done with the Howard stirrer, air jets, or other mechanical means. Air accelerates the reaction. The arsenic content of the metal can be reduced to any desired quantity by fractional additions of caustic. The process gives a metal practically free of copper and arsenic if desired.

The arsenic in the caustic skim is in the form of sodium arsenate, available for the manufacture of insecticides by leaching with water. The leached residue, containing lead and possibly a small amount of antimony, can be readily treated. Milk of lime can be added to the sodium arsenate solution to form calcium arsenate, and after filtration the solution can be treated for recovery of caustic soda if desired. This affords a possible means of a profit on the operation from the value of the calcium arsenate recovered.

Parkes process antimonial lead contains amounts of copper and arsenic that unfit it for many uses, particularly the manufacture of storage-battery plates, and has thereby limited the market for antimonial lead. It is a matter for the metallurgist to determine whether to remove the copper and arsenic from the lead bullion or to remove the copper and arsenic from the antimonial lead. In the production of antimonial lead, even if the antimonial slags were originally free of copper, there is a strong possibility that copper will be found in the antimonial lead from the fluxes used in its smelting. Another U. S. Patent, No. 1,386,503, owned by the United States Smelting, Refining & Mining Co., covers the decopperizing of lead bullion by the Hulst process.

The Colcord process may also be of considerable interest to the secondary-metals industry, which today treats large quantities of lead-antimonial material in which copper and arsenic are usually present.

Structural Engineers' Handbook. Third Edition. By Milo S. Ketchum. McGraw-Hill Book Co., New York. Price $7.50.

Technical Mechanics. Fifth Edition. By Edward R. Maurer and Raymond J. Roark. John Wiley & Sons, New York. Price $3.50.

These two veteran texts have been thoroughly tested in classroom and field and are standard works in their respective fields. The new editions keep pace with the progress that is being made in theoretical and practical mechanics. Professor Ketchum has added much new data to his book; in particular, revised specifications for steel frame buildings and highway bridges, design of self-supporting steel stacks, and standards for "constant dimension steel columns."

"Technical Mechanics" has been rewritten to attain improvement in presentation and subject matter and to include a large number of solved examples and problems.

English Mine Directory—A list of mines in Great Britain, giving the name and address of owner, name of manager, number of employees, mineral worked, and similar data, indexed in several ways, has been published by the Mines Department, and is obtainable for 15s., net, from H. M. Stationery Office, Adastral House, Kingsway, London, W. C. 2, England.

Rhodesia Mining—The annual report of the Rhodesia Chamber of Mines, Bulawayo, for 1923, is now available, as a cloth-bound book of 70 pages.

Gypsum and Anhydrite—"Effects of Temperature and Pressure on Gypsum and Anhydrite" are discussed by Marie Farnsworth in U. S. Bureau of Mines *Reports of Investigations*, No. 2,654, 3 pages, obtainable on request from the Bureau at Washington, D. C. The tests described indicate that anhydrite cannot be rehydrated under conditions of high temperature and pressure.

Alum Deposits—"Deposits of Magnesia Alum Near Fallon, Nevada," is the title of U. S. Geological Survey Bulletin 750-E, 7 pages, by D. F. Hewett, obtainable from the Survey, Washington, D. C., free. There is a deposit of about 17,000 tons of rock containing 15 per cent of soluble magnesia alum, and 13,000 tons containing 10 per cent.

Carnotite Associates—Bulletin 750-D of the U. S. Geological Survey, Washington, D. C., 16 pages, by Frank L. Hess, discusses "New and Known Minerals From the Utah-Colorado Carnotite Region." These include vanoxite, rauvite, metatorberite, zippeite, and tyuyamunite. Copies of the bulletin obtainable free.

Geophone—"Improvement of the Geophone by the Use of Electrical Sound Amplifiers" is discussed by Walter T. Ackley, Jr., and Clifton M. Ralph in U. S. Bureau of Mines *Reports of Investigations* No. 2,639, obtainable on request.

New Machinery and Inventions

Largest Storage-battery Mine Locomotive Charged With Pole From Overhead Wire

At Dawson, New Mexico, a prominent copper-mining company has been experimenting with storage-battery locomotives to do all of the hauling in its coal mines there and with storage batteries to operate the mining machines. The equipment used is of particular interest. The largest mine has a main haul of 6,000 ft. from the inside parting to the outside yard, with an average grade of 1 per cent against the loads. From eight to ten trips a day are required of each of the two locomotives on this run. At present one of the original trolley locomotives has been replaced by a storage-battery locomotive, which is considerably larger than any storage-battery locomotive that has previously been put into a mine. It consists of two ten-ton chassis units operated in tandem, each chassis having two 60-hp. motors and each carrying a battery of 88 cells, MVX-29 Exide Ironclad. All electrical parts are inclosed, in accordance with Schedule 15 issued by the U. S. Bureau of Mines. Every precaution has been taken in the design of the locomotive to make it safe if operated in explosive mixtures of air with gas or coal dust.

Contactor control is used for acceleration, contactors being operated by a master controller in each unit.

Reversing and switch connections are operated directly, from either unit of the locomotive. The two units are coupled with the controller ends apart, and, as the pair can be operated from either unit, they really combine to make up a double-end control locomotive.

Because of the heavy power demand in this installation, the batteries are required to deliver as many as two complete discharges per day. To provide this extra current the trolley pole is put onto the wire as soon as the locomotive comes out of the mine portal. So, while the locomotive is operating from the portal to the yard and back, it receives its power from the trolley wire, and the battery is boosted at as high a rate as the battery is in condition to receive. During the first part of the day the maximum permissible charging rate is rather small, but as the battery becomes more discharged this rate is automatically increased until by the middle of the afternoon as much power is put into the battery while it is outside of the mine as is used for that trip inside of the mine.

The charging rate is controlled by a series of automatic switches operated from a special ampere-hour meter. As soon as the trolley pole is put on the wire, charging automatically begins, but when the pole is removed from the wire these switches drop out, disconnecting the pole from the batteries so that there is no danger of a short circuit should the pole come in contact with the locomotive frame.

A switch is provided on each locomotive so that as separate units the locomotive can be operated in either direction. Operated in tandem the direction of motion of both units is determined by the switch on the control unit.

A switch is provided on each locomotive so that power can be obtained from either storage battery or trolley wire. Operated in tandem, the choice of power can be determined by the switch on the control unit.

The positions of these switches which transfer choice of direction and power to the other unit are called "secondary positions." When the switches on the secondary unit are in a secondary position the master controller on that unit is locked in the "off" position. Unless both switches on the secondary unit are set in the secondary position, that unit will not operate, but will merely be carried along as dead weight.

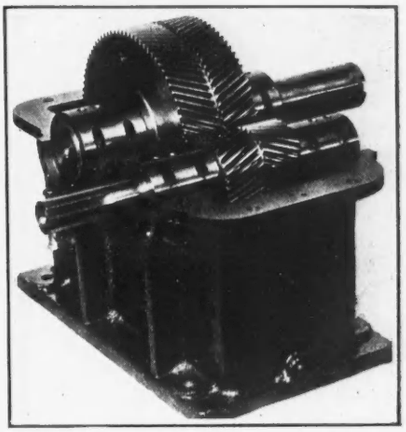
While the locomotive is moving under the power of one unit only, should the switch on the secondary unit be moved to the secondary position that unit would immediately pick up, but after having once been moved to the secondary position it cannot be moved back until the power is shut off. Whenever the master controller on one unit is moved from the "off" position, the master controller on the other unit is locked and remains locked until the controller on the first unit is moved back to the "off" position. Any attempt to operate both controllers at exactly the same time would result in their both being locked between the "off" and first-point position, and neither of them could get to the first-point position until the other had been turned to the "off" position. This interlocking arrangement prevents the possibility of any combination of switch positions that would cause a short circuit or an arc that might destroy the safety provisions of the locomotive.

This locomotive, which now has been in service since May, 1924, was examined recently, and the batteries showed that in spite of the very severe duty imposed upon them they were in perfect condition, and that the automatic charging arrangements have been successful in preventing charging currents that might be injurious. These units may be briefly described as locomotives that may be operated singly or in pair from a battery or from a trolley wire, with automatic charging of the battery whenever the pole is put on the wire.

Inclosed electrical parts, with interlocks, prevent any improper combination of switch and controller connections. Each unit consists of a ten-ton chassis, carrying nine additional tons of mechanical equipment and storage battery. This makes the total weight of the pair thirty-eight tons. The manufacturer of the locomotives is the Goodman Manufacturing Co., of Chicago, Ill.

Two New Reduction Gears

The Poole Engineering & Machine Co., of Baltimore, Md., has recently brought out two new types of reduction gears known as their Type H and Type K. The Type H reduction gear or speed transformer consists of a double helical or herringbone gear made of special analysis open-hearth steel forging and a herringbone pinion cut integral with a high-speed shaft made of chrome vanadium steel. Both gear members are heat treated to proper hardness to



Type H reduction gear, with top casing removed

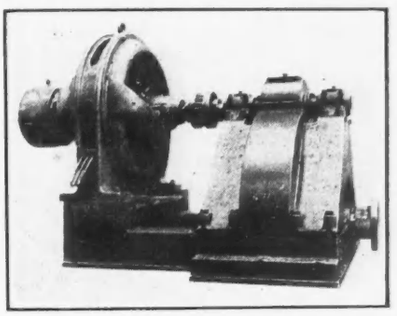
minimize wear. Gear members are accurately ground and carefully tested for static balance before being assembled in gear casing.

Gears and pinions are totally inclosed in a cast-iron horizontally split casing with bearing bosses integral with the top and bottom halves of casing.

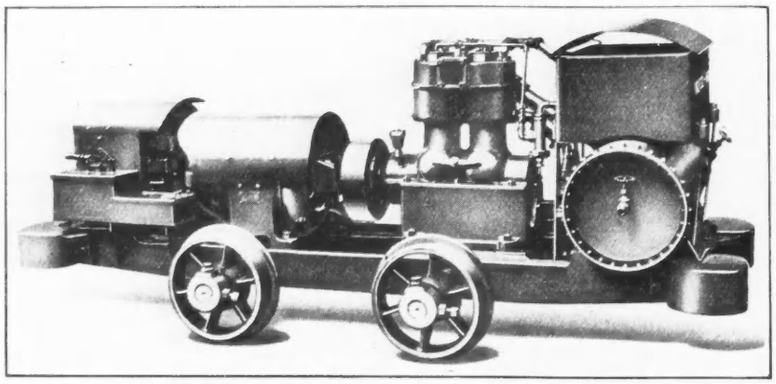
The bearings are removable, consisting of cast-iron shells lined with babbitted metal, and are supported in bosses integral with top and bottom halves of casing, insuring accurate and permanent alignment.

For low-speed drives thorough lubrication is obtained by an improved splash and gravity system in which the gear dips in the oil sufficiently to carry oil to a reservoir in the upper casing from which it feeds to all bearings and directly between the gear teeth at the line of contact. For turbine and other high-speed drives, an oil pump and cooler is provided, thus insuring cool oil under pressure to the bearings and gear teeth.

The Type K reduction gear consists



Type K reduction gear



In this portable "mine-car" air compressor vibration is lessened by vertical arrangement of the cylinders

of double helical or herringbone forged-steel pinion integral with shaft and a cast steel double helical spur gear. Both gear and pinion have cut stub teeth. The gear and pinion shafts are mounted in substantial babbitted bearings of the ring oiling type and the gear and pinion are lubricated by the splash system; the gear and pinion running in an oil tight oil filled case.

The high-speed shaft or driving pinion in the Type K gear is located in the top of the casing and the driven shaft is directly under the pinion shaft and just below or near the floor line, which makes it especially desirable for certain types of machines used in industries where the line shaft is close to the floor.

Vertical Cylinders Lessen Compressor Vibration

With the extensive adoption of electrical distribution of power in and about the mines has come a demand for portable electrically driven air compressors that can be moved readily from point to point within the workings. Unquestionably certain kinds of pneumatic tools, especially percussive rock drills and similar apparatus, are more efficacious than those electrically driven. Utilization of small compressors for driving such machines obviates the employment of the long and expensive pipe lines rendered necessary if a central compressing plant on the surface is the only available source of compressed air.

A new line of machines of this variety, known as Type 20, has recently been placed on the market by the Ingersoll-Rand Co., 11 Broadway, New York, one of which is shown in the cut at the top of the page. This type of compressor embodies several radical changes in design from machines of like character previously built. The truck is much like that of an ordinary mine car except that it consists essentially of a steel-casting frame. This is mounted on ordinary mine-car wheels set at approximately the regular mine-car wheel base.

The improvement of chief interest embodied in this machine is the compressor itself. This is a two-cylinder, vertical, single-acting device mounted directly over one of the truck axles. Several of the structural details of this machine have been borrowed or adapted from automobile practice. Thus the upper half of the crank case, the cylinders and the water jackets are all cast *en bloc*. The same is true of the cylinder heads containing the valves and valve chambers.

Lubrication is of the fixed level, splash variety, that is, oil is pumped from the crank case reservoir to pans beneath the cranks. Thence it is carried to the bearings, gears and pistons by the aid of dippers on the lower ends of the connecting rods. So long as oil remains in the reservoir lubrication of all internal parts is copious and adequate.

The compressor is connected to, and driven by, a motor mounted over the other axle of the truck. This machine may be of either the direct- or alternating-current type. Motor and compressor are joined by means of an easily detachable flexible coupling. The smallest machine of this type has no reduction in speed between motor and compressor; the two larger sizes are provided with back gears. These are housed in an extension of the crankcase where they receive ample lubrication.

Electrical - control equipment is mounted on the motor end of the truck, and a cylindrical air receiver, together with a tank for the jacket water, is similarly mounted on the other end. The arrangement is compact yet accessible, and all parts requiring protection are either shielded or completely housed.

It is impossible to balance a reciprocating machine of this kind perfectly, and a certain degree of vibration is unavoidable. In any device of this nature, however, the unbalanced force of the vibration will exert itself in the line of the piston movement. Making the air compressor vertical and placing it directly above one of the truck axles practically places a foundation under the machine so that it is unnecessary to block the truck in any way. The general construction of this compressor and the fact that light plate valves are used renders it possible to operate at high speed. This in turn means cheaper construction and lighter weight for a given capacity.

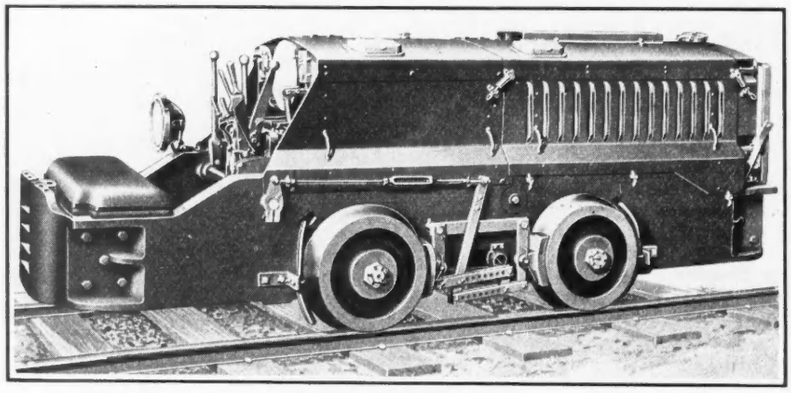
In addition to the fact that vibration is negligible and blocking is unnecessary, the manufacturers claim the following advantages: The machine is compact; it is a truly portable piece of equipment, not merely a stationary unit mounted on wheels, and it delivers approximately 20 per cent more air per dollar of first cost than its predecessors. This compressor at present is manufactured in three sizes, namely, 5 x 5, 7 x 6, and 9 x 8 in., the corresponding piston displacements being 91, 160, and 230 cu.ft. per minute respectively.

Another Screen Announced

A new screen known as the Rotex Jumbo screen for handling crushed rock has been introduced by the Orville Simpson Co., of Cincinnati, Ohio. This screen is a gyrating machine with a screen surface 8 ft. wide by 12 ft. long. It is built of structural steel and steel castings and weighs nearly three tons. The manufacturer claims that it is non-clogging.

A Small Four-speed Gear-driven Mine Locomotive

A new Plymouth gasoline locomotive for mine use that has not hitherto been announced has recently been brought out by the Fate-Root-Heath Co., of Plymouth, Ohio. This is known by the company as its model FL, Type 4, four-ton gear-driven locomotive. The principal feature is that it is a four-speed gear-driven machine. It is of rugged and substantial design and of unusual power, the maker claims. It is built on the same design as the model DL seven - ton gear - driven Plymouth. The smaller model is said to develop easily a draw-bar pull of 3,000 lb. in first speed on a sanded rail and a correspondingly high draw-bar pull on other speeds. The speeds are 2⅔, 4, 8, and 12 miles per hour, either forward or reverse. A method of mounting the transmission is provided which insures absolute rigidity and, at the same time, perfect alignment with the engine.



This new gasoline mine locomotive is gear-driven, with four speeds

The Market Report

Daily Prices of Metals

Jan.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
15	14.825	57.75	58.25	10.575	10.35	7.85@7.90
16	14.75	56.50	57.00	10.50	10.25	7.80
17	14.75	56.25	56.75	10.50	10.25	7.80
19	14.70	56.50	57.00	10.50	10.25	7.80@7.825
20	14.625	55.625	55.75@56.75	10.50	10.25	7.75@7.80
21	14.50	55.50	56.00	10.00	9.75	7.60@7.65
Av.	14.692	56.354	56.875	10.429	10.183	7.781

*These prices correspond to the following quotations for copper delivered: Jan. 15th, 15.075c.; 16th and 17th, 15.00c.; 19th, 14.95c.; 20th, 14.875c.; and 21st, 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

Jan.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
15	66⅜	67½	71¼	265½	269¾	42⅝	40⅞	38⅝	38
16	65⅞	67	71	259	263	41⅜	39½	37½	37
19	65⅞	67	70¾	259¼	263¼	41⅞	40	37 15/16	37 7/16
20	65¼	66¼	70½	259	263	41½	39½	38	37⅜
21	64⅝	65¾	69½	255¾	259⅝	39⅝	37⅝	37⅜	36⅝

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

Jan.	Sterling Exchange "Checks"	Silver		Gold London	Jan.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
15	4 77¾	68½	32 3/16	87s 1d	19	4.77⅝	68⅜	32⅛	87s 1d
16	4. 77⅛	68⅛	32⅛	87s 2d	20	4.77⅛	68⅜	32 3/16	87s 2d
17	4 77	68⅜	32 5/16	.....	21	4.77¾	68⅝	32 5/16	87s 3d

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 React Strongly Downward

New York, Jan. 21, 1925—A pronounced decline in metal prices abroad, with a marked slackening in domestic demand since the holidays, has caused the non-ferrous metal market here to be much weaker, and consumers are pretty generally holding aloof until they see how far the reaction will go. After the continued advances in price, and large volume of buying, that have taken place in the last two or three months, the present state of the market was not totally unexpected. Although prices may drop somewhat further before sufficient buying appears to support the market, there is nothing to indicate that the reaction will be continued over any great length of time, as fundamental business conditions in the United States are excellent, with car loadings setting new records. In Europe, also, business continues to pick up. It is probable that selling of speculative lots of metal, particularly by German interests in London, has been the principal influence in the decline.

Copper Drops Below 15c.

Sales of speculative and odd lots of copper have practically established the copper market since last Friday. Consumers have not been greatly interested at any time this month, and were still less so during the last week, when continued declines were reported from London. They have, however, been keenly alive to bargains, and the brass companies particularly have seized on the various lots of copper that have been offered at from 14¾ to 15c. delivered, with avidity. The large producers are in an excellent position, and have shown no tendency to follow the market below 15c.; in fact, some are quoting firmly at 15¼c. still, though fully realizing that no sales are possible at that level except for special shapes. Most of the copper sold in the domestic market during the week has passed through the hands of one selling agency, which sold at 15c., delivered, to the close of Saturday's business, but which is offering the metal for first quarter delivery today at 14¾c.

The export market has been exceedingly inactive.

A Free Market for Lead

The contract price for lead, New York, quoted by the American Smelting & Refining Co., was reduced today, Jan. 21, from 10.50 to 10c. This is the first decline since May 22, 1924, when the price was reduced from 7.25 to 7c. The violent decline in lead prices in London today, of almost £2, made it necessary for the smelting company to reduce its prices or see lead bullion enter this country from foreign shores.

The tendency on the part of consumers to remain off the market rather than pay more than 10c. per lb. for their lead was in evidence more or less last week. Since then, in view of the declines in London, this tendency has been considerably more manifest, so that the long waiting lists are rapidly vanishing from producers' order books, if they have not entirely done so by tonight. Ever since last Thursday, producers have been selling rather freely at 10¼c., St. Louis, and 10½c. New York.

Consumption continues unabated, and buyers have only scanty stocks of lead in their warehouses, with a considerable tonnage of February lead still to be bought. Though buying has not amounted to much in the last two or three days, it must spring up again before long. On the other hand, there is no doubt that production has been stimulated to a considerable degree; whether sufficiently to take care of the present consuming demand remains to be seen. Also, some of the smaller producers have overstayed their market, and are now offering lead that they were holding firmly until a week ago.

Zinc Declines to 7.60c.

Zinc has shared in the general decline in metal prices, though no special features have been outstanding in this market. The price recently has

been set by what producers could realize on export business, and with the decline in London today to £36§, sellers have been willing to take as low as 7.60c. for domestic business, though nominal asking figures are 7.65c. Most of the sales have been made for January shipment, but some metal has been booked for as late as April. Forward delivery is somewhat more freely offered than spot, though no marked concessions in price are allowed. The export market has been weak. High-grade zinc is unchanged at 8¾c.

Tin Drops 2c. a Pound

A fair volume of sales were made early in the week ending today, when slight declines in prices were taken advantage of, but the pronounced drop yesterday, when prices declined a full cent during the day, seems to have scared away buyers rather than attracting them. Forward Straits has sold at about the same prices as spot.

Arrivals of tin to Jan. 21 were 5,185 tons, according to the New York Metal Exchange.

Sterling Exchange Steady

Sterling exchange held steady all week at from 4.77 to 4.78; no marked changes occurred in the other foreign currencies. Closing cable quotations on Tuesday, Jan. 20, were: francs, 5.395c.; lire, 4.10c.; and marks, 23.81c. Canadian dollars, 13/32 per cent discount.

Silver Steady and Quiet

The market has held steady on purchases from India and London, and closes quiet.

Mexican Dollars: Jan. 15th, 52¾c.; 16th, 52½c.; 17th, 52§c.; 19th, 52§c.; 20th, 52§c.; 21st, 52¾c.

Circulation Statement

The circulation statement of United States money for Jan. 1, 1925, is as follows:

Gold coin and bullion	$4,547,407,014
Gold certificates	(1,508,993,659)
Standard silver dollars	511,919,851
Silver certificates	(438,299,305)
Treasury notes of 1890	(1,404,877)
Subsidiary silver	283,156,178
United States notes	346,681,016
Federal Reserve notes	2,244,961,180
Federal Reserve Bank notes	8,559,193
National Bank notes	772,046,817
Total	$8,714,731,249

Figures in parenthesis are not included in total.

Stocks of gold in the United States decreased during December, for the first time in several years, and shipments are likely to continue for some time. This turn in the gold flow is looked on with great favor by economists.

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—Per lb.:
Chinese brands, 17½c.
Cookson's "C" grade, 19½c.
Chinese needle, lump, nominal, 10c.
Standard powdered needle, 200 mesh, 11½@13c.

White oxide, Chinese, 99 per cent Sb_2O_3, 14¾@16c.

Bismuth—$1.30@$1.35 per lb. 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, $111@$113.

Quicksilver—$82@$83 per 75-lb. flask. San Francisco wires $81. Quiet. London, £14.

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

Metallic Ores

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

Tungsten Ore—Per unit, N. Y.:
Chinese wolframite, $9.
High-grade Western scheelite, $9.50.

Iron Ore, Galena Radio Crystals, Manganese, Molybdenum, Tantalum. and **Vanadium Ores** are unchanged from Jan. 3 quotations.

Zinc Blende Lower—Lead Ore Higher

Joplin, Mo., Jan. 17, 1925

Zinc Blende	Per Ton
High	$62.60
Premium, basis 60 per cent zinc	$57.00@$58.00
Prime Western, 60 per cent zinc	$55.00
Average settling price, all	$56.95
Lead Ore	
High	$142.80
Basis 80 per cent lead	$146.00
Average settling price, all	$140.00

Shipments for the week: Blende, 12,517; lead, 2,454 tons. Value, all ores the week, $1,056,590.

Blende production is estimated to have risen to 17,000 tons in the last week, with a number of mills operating night shifts. Favorable weather has made this possible.

Lighter demand brought a cut of $2.50 to $3 on Prime Western grades, a $2 cut on premium, and $3 to $4 cut on fines and slimes.

Lead demand continues sharp, but with less competition in price making, an advance of only $1 per ton being made.

Platteville, Wis., Jan. 17, 1925

Zinc	Per ton
Blende, basis 60 per cent zinc	$60.75
Lead	
Lead, basis 80 per cent lead	$145.00

Shipments for the week: Blende, 608 tons; lead, none. Shipments for the year: Blende, 1,443; lead, 80 tons. Shipments for the week to separating plants, 1,355 tons blende.

Non-Metallic Minerals

Feldspar—Per net ton, in bulk, f.o.b. mill.

No. 1 Porcelain grade (Virginia) 140 mesh, $22; No. 1 Body spar (Maryland) 120 mesh, $17; Enamelers' grade (Maryland) 80-100 mesh, $13.50@$16; Enamelers' grade (Virginia) 100 mesh, $20; Glassmakers' grade (Virginia) 30-100 mesh, $19; Glassmakers' grade (Maryland) 30-100 mesh, $13@$15.

Other feldspar quotations in Jan. 3 issue.

Amblygonite, Asbestos, Barytes, Bauxite, Beryl, Borax, Celestite, Chalk, China Clay, Corundum, Diatomaceous Earth, Emery, 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 Jan. 3 prices.

Mineral Products

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

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and **Zinc Oxide** are unchanged from Jan. 3 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 Ferrovanadium are unchanged from the prices given in the Jan. 3 issue.

Metal Products

Rolled Copper — Sheets, 23c.; wire, 17½c.

Lead Sheets—Full lead sheets, 14c. per lb.; cut lead sheets, 14½c. in quantity, mill lots.

Nickel Silver—29½c. per lb. for 18 per cent nickel Grade A sheets.

Yellow Metal — Dimension sheets, 20§c. per lb.; rods, 17§c. per lb.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick, and **Zirkite** are unchanged from Jan. 3 prices.

Steel Steady—Pig Iron Up

Pittsburgh, Jan. 20, 1925

Week by week there is a fair run of fabricated steel business and as nearly all options have run out prices done on fabricated steel are approaching a harmony with present mill prices on the plain shapes, 2.10c. for shapes and bars and 2.00c. for plates. The industry is operating at approximately 85 per cent. Steel prices are steady and unchanged.

Pig Iron—Recent asking prices on bessemer and basic pig iron are confirmed by actual sales, making the market quotable 50c. higher at $23, Valley, for bessemer and $22 for basic. Foundry remains at $22@$23. Buying is light.

Connellsville Coke—The market has weakened farther and is now at approximately the prices of three months ago plus the cost of the recent wage advance. Spot furnace, $4; contract furnace, $4.50; spot foundry, $4.75@$5.25.

Mining Stocks

Week Ended January 10, 1925

Mining stock quotations for week ended Jan. 17 on following page

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb			*6		
Anaconda	New York	48	46½	46¾	Ja.17, Fe.16,	0.75
Arcadian Consol.	Boston	3	2⅞	3		
Ariz. Com'l.	Boston	15	13¼	14½	July 1924	0.50
Calaveras	N. Y. Curb			2		
Calumet & Arizona	New York	*58	*54	*57½	De.5, De.22 Q	0.50
Calumet & Hecla	Boston	18⅜	17⅞	18	June 1924	0.50
Canario Copper	N. Y. Curb	4½	3¾	4¼		
Cerro de Pasco	New York	55⅛	52⅞	54⅛	Oc. 23, No. 1	1.00
Chile Copper	New York	37	38⅛	36⅜	De.3, De.29, Q	0.62½
Chino	New York	27½	26	26½	Sept., 1920	0.37½
Con. Coppermines	N. Y. Curb	3 1/16	3 1/16	3⅛		
Copper Range	Boston	33	30¼	33	May, 1924	1.00
Crystal Copper	Boston Curb	*59	*56	*58		
Davis-Daly	Boston	*75	*70	*75	Mar., 1920	0.25
East Butte	Boston	6	5⅞	5⅞	Dec., 1919	0.50
First National	Boston Curb	*35	*32	*35	Feb., 1919	0.15
Franklin	Boston	*60	*40	*60		
Gadsden Copper	Boston Curb	*74	*65	*74		
Granby Consol.	New York	20⅛	19	20⅛	May, 1919	1.25
Greene-Cananea	New York	19	18⅜	19	Nov., 1920	0.50
Hancock	Boston	1¼	1¼	1¼		
Howe Sound	N. Y. Curb	3⅜	3	3⅜	April 1924	0.05
Inspiration Consl.	New York	107⅛	107½	107½	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb	4⅜	3	3	May, 1923	0.15
Isle Royale	Boston	20⅛	19	19⅛	Sept. 1923	0.50
Jerome Verde Dev.	N. Y. Curb	1	*99	*99		
Kennecott	New York	57	54	56⅛	De.2, Ja.2, Q	0.75
Keweenaw	Boston	1⅛	1	1⅛		
Lake Copper	Boston	3	2½	3		
Magma Copper	New York	43½	40	43½	Jan., 1919	0.50
Mason Valley	N. Y. Curb	2½	2⅛	2½		
Mass Consolidated	Boston	1	1	1	Nov., 1917	1.00
Miami Copper	New York	24⅛	22½	24	Fe.2 Fe.16 Q	0.50
Mohawk	Boston	39½	35⅛	39½	Se. 22, Oc. 13	1.00
Mother Lode Coa.	New York	9⅛	8⅞	9	De. 12, De. 31	0.37½
Nevada Consol.	New York	16⅛	15⅛	15⅞	Sept., 1920	0.25
New Cornelia	Boston	24⅞	24	24⅞	No. 7, No. 24	0.25
New Dominion	N. Y. Curb			2⅛		
North Butte	Boston	2⅞	2⅜	2⅜	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	1⅜	1 1/16	1 1/16	No.14, De.2	0.05
Old Dominion	Boston	27	24	26¼	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†109	†107		De.2, Ja.2 Q	1.00
Quincy	Boston	38	29	37½	Mar., 1920	1.00
Ray Consolidated	New York	16⅛	15⅜	15⅛	Dec., 1920	0.25
Ray Hercules	N. Y. Curb	*14	*12	*14		
St. Mary's Min. Ld.	Boston	46½	43½	46	May 1924	3.00
Seneca Copper	New York	1⅜	1⅛	1⅛		
Shannon	Boston	1⅛	1⅛	1⅛	Nov., 1917	0.25
Shattuck Arizona	New York	7⅛	7⅛	7⅛	Jan., 1920	0.25
Superior & Boston	Boston	2	1 9/16	1⅞		
Tenn. C. & C.	New York	9⅛	8⅞	9	De.31, Ja.15,Q	0.25
United Verde Ex.	N. Y. Curb	29⅞	29⅛	29⅛	Ja. 2, Fe. 2	0.50
Utah Copper	New York	88⅞	86	88⅛	De.12, De.31,Q	1.00
Utah Metal & T.	Boston	*45	*42	*43	Dec., 1917	0.30
Victoria	Boston	*85	*85	*85		
Walker Mining	N. Y. Curb			3⅜		
Winona	Boston	*48	*25	*48		
NICKEL-COPPER						
Internat. Nickel	New York	26⅛	25⅛	26	March, 1919	0.50
Internat. Nickel pfd.	New York	95⅞	94	95	Ja. 15, Fe. 2, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	4⅛	4	4⅛		
National Lead	New York	166⅛	159	162¼	De.12, De.31, Q2	2.00
National Lead pfd.	New York	116⅛	116	116½	No.21,De.15, Q	1.75
St. Joseph Lead	New York	45⅞	43	45⅛	De. 9, De. 20	0.50
ZINC						
Am. Z. L. & S.	New York	12⅛	10⅛	10⅜	May, 1920	1.00
Am. Z. L. & S. pfd.	New York	39	34	38	Nov., 1920	1.50
Butte C. & Z.	New York	8⅜	8⅛	8⅛	De.10, De.24	0.50
Butte & Superior	New York	24⅛	21⅛	23⅛	June, 1923	0.50
Callahan Zn-Ld.	New York	4⅛	4⅛	4⅛	Dec., 1920	0.50
New Jersey Zn.	N. Y. Curb	198⅛	193⅛	195¼	Ja.20, Fe.10	2.00
United Zinc	N. Y. Curb			*15		
Yellow Pine	Los Angeles	*80	*75	*80	De.10,De.15 Q	0.04
SILVER						
Alvarado	Boston Curb	1⅛	1⅛	1⅛	Oct. 1920	0.50
Beaver Consol.	Toronto	*31⅛	*27½	*31	May, 1920	0.03
Castle-Trethewey	Toronto	*80	*79	*79½		
Coniagas	Toronto	2.40	2.30	2.30	May, 1924	0.12½
Keeley	Toronto	2.20	2.17	2.19	Sept. 15, SA	0.12
Kerr Lake	N. Y. Curb			1⅞	Oc. 1, Oc. 15,	0.12½
La Rose	Toronto	*15	*12½	*14	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1.35	1.33	1.34		
McKinley-Dar.-Sav.	Toronto	*23	*17½	*19	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.15	2.05	3.10	Sept., 1919	0.12½
Nipissing	N. Y. Curb	6½	6½	6½	Ja.18,Ja.20,QX	0.30
Ontario Silver	New York			6¼	Jan., 1919	0.50
Temiskaming	Toronto	*30	*30	*30	Jan., 1920	0.40
GOLD						
Alaska Gold	New York	*25	*17	*20		
Alaska Juneau	New York	1⅛	1	1⅛		
Argonaut	Toronto	*38½	*25½	*37½		
Carson Hill	Boston	*70	*50	*70		
Consol. W. Dome L.	Toronto	*21½	*19½	*20½		
Cresson Consol. G.	N. Y. Curb	3 1/16	3/32	3 1/16	De.31, Ja.10,Q	0.10
Crown Reserve	Toronto	*53	*52½	*52½	Jan. 1917	0.05
Dome Mines	New York	15½	15½	15½	De.31, Ja.20, Q	0.50
Golden Cycle	Colo. Springs	1.48	1.42	1.48	Dec.11, 1924	0.03
Hollinger Consol.	Toronto	15.15	15.00	15.05	Ja.12, Ja. 28, M	0.05
Homestake Mining	New York	48½	44½	48¼	Ja.20,Ja.25,MX	1.50
Jib. Cons l.	N.Y. Curb	*55	*50	*55		
Kirkland Lake	Toronto	*42	*37½	*41½		
Lake Shore	Toronto	4.98	4.85	4.95	De.1,De.15,QX	0.10
McIntyre-Porcupine	New York	16½	16½	16½	No. 1, De. 1	0.25
Newray	Toronto	*30	*28	*28		
Night Hawk Pen.	Toronto	*30	*30	*30		
Portland	Colo. Springs	*42½	*40	*42½	Oct., 1920	0.01
Rand Mines	New York	35½	33⅜	35¼	Aug. 1924	1.71
Teck-Hughes	Toronto	1.33	1.21	1.31		
Tom Reed	Los Angeles	*40	*38½	*38½	Dec., 1919	0.02
Tough-Oakes	Toronto	*44	*40	*43½		
United Eastern	N. Y. Curb			*35	July, 1924	0.05
Vipond Cons.	Toronto	1.41	1.39	1.40		
Wright-Hargreaves	Toronto	4.40	4.35	4.35	De.15, Ja.2,QX	0.05
GOLD AND SILVER						
Black Oak	N. Y. Curb			*81		
Con. Cortez	N. Y. Curb	*10	*10	*10		
Con. Virginia	San Francisco	8⅛	6½	6½		
Continental Mines	N. Y. Curb			1⅛		
Dolores Esperanza	N. Y. Curb			*26	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅛	2⅛	2⅛	De.22, Ja.5,QX	0.10
Tonopah Belmont	N. Y. Curb	*59	*55	*59	Apr., 1923	0.05
Tonopah Divide	N. Y. Curb			*20	Se. 22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	3⅛	3	3	De.11, Ja.1	0.05
Tonopah Mining	N. Y. Curb	1⅞	1⅞	1⅞	Se.20, Oc.31	0.07½
Unity Gold	N. Y. Curb	*68	*68	*68		
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	11	9⅛	10⅛	De.15, Ja.2, X	0.15
Bingham Mines	Boston	31⅜	30⅛	30⅛	De.20, Ja.2	0.50
Cardiff M. & M.	Salt Lake	1.15	1.15	1.15	De.16, No.18	0.10
Chief Consol.	Boston Curb	4	3⅛	4	May, 1924	0.10
Columbus Rexall	Salt Lake	*25⅛	*25	*25⅛	Aug., 1923	0.05
Daly Mining	Salt Lake			1.50	July, 1920	0.10
Erupcion	Boston Curb	3⅛	2⅜	3⅛	De.15, Ja.2, X	0.15
Federal M. & S.	New York	24	22⅛	23	Jan., 1909	1.50
Federal M. & S. pfd.	New York	62	60½	62	No.25, De.15,	1.75
Florence Silver	Spokane	*9	*5½	*9	Apr., 1919, QX	0.01
Hecla Mining	N. Y. Curb	13⅜	13¼	13¼	No.15, Dn.15	0.25
Iron Blossom Con.	N. Y. Curb			*26	Oc.25, 1924	0.02½
Marsh Mines	N. Y. Curb			*6	June, 1921	0.02½
Park City	Salt Lake			5	De. 15, Ja.4	0.15
Park Utah	Salt Lake			3½	April, 1924	0.15
Prince Consol.	Salt Lake	*19	*18½	*19		
Silver King Coal	Salt Lake	5.75	5.75	5.75	De.20, Ja.2, Q	0.50
Silversmith	Spokane	*27½	*25	*26	Ja. 1, Ja. 10	0.02
Tamarack-Custer	Salt Lake	*97	*85	*85	Se. 22, Se. 29	0.25
Tintic Standard	Salt Lake	9.00	8.50	8.90	Ja.2, QX	0.50
Utah-Apex	Boston	5⅛	4⅞	5⅛	Ja.10, Ja.15,	0.25
IRON						
Bethlehem Steel	New York	53	50⅜	51½	Jn.1, Jy.1, Q	1.25
Char. Iron	Detroit	*20	*20	*20		
Char. Iron pfd	Detroit	*74	*72	*74		
Colorado Fuel & Iron	New York	45⅜	42⅛	43½	May, 1921	0.75
Gt. North'n Iron Ore	New York	38	35½	37½	De.10, De.27	2.00
Inland Steel	New York	47⅜	45⅝	46⅛	De. 1924, Q	0.625
Mesabi Iron	N. Y. Curb	4⅜	4	4⅛		
Replogle Steel	New York	21⅛	19⅜	20⅛		
Republic I. & S.	New York	63⅛	60	62⅛	May, 1921	1.50
Republic I. & S. pfd.	New York	94	94	94	De.16, Ja.2, Q	1.75
Sloss-Sheffield S. & I.	New York	85	82	84½	Dec., 1924 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	96⅜	95½	95½	De.20, Ja.2, Q	1.75
U. S. Steel	New York	124½	120½	124	No.29,De.3, QX	1.75
U. S. Steel pfd.	New York	123½	122⅜	123	No.4, No.29, Q	1.75
Virginia I. C. & C.	New York	43⅛	43⅛	43⅛	De.15, Ja.2	1.50
Virginia I.C.&C.pfd.	New York	79⅛	79⅛	79⅛	De. 13, Ja. 2, Q	2.50
VANADIUM						
Vanadium Corp.	New York	31	28⅛	30⅛	Jan., 1921	1.00
ARSENIC						
Western Utah Copper	N. Y. Curb	*20	*15	*20		
ASBESTOS						
Asbestos Corp.	Montreal	38	38	38	Oct., 1924 Q	1.00
Asbestos Corp. pfd.	Montreal	74	74	74	Ja.2, Ja.15, Q	1.50
SULPHUR						
Freeport Texas	New York	11⅛	10⅛	10⅞	Nov., 1919	1.00
Texas Gulf	New York	107⅛	101⅛	103⅛	De.1,De.15, QX	2.25
DIAMONDS						
De Beers Consol	New York			23⅞	Aug. 1924	0.88
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3⅛	3	3⅛		
MINING, SMELTING AND REFINING						
Amer. Metal	New York	53	51	52⅛	No.19, De.1 Q	0.75
Amer. Metal pfd.	New York	116⅛	115	115	No.20, De.1, Q	1.75
Amer. Sm. & Ref.	New York	99	95⅛	97	Ja.16, Fe.2, Q	1.50
Amer.Sm.&Ref.pfd.	New York	108⅛	105⅛	108⅛	Fe.6, Mh.2 Q	1.75
Consol. M. & S.	Montreal	52⅛	48	51⅛	De.11, Ja.15 SA	0.75
Federated Metals	N. Y. Curb	38	36⅜	37⅛		
Southwest Metals	N. Y. Curb			2		
U. S. Sm. R. & M.	New York	39	37	38	Jan., 1921	0.50
U.S. Sm. R.&M.pfd.	New York	46⅛	46⅛	46⅛	Ja.8, Ja.15	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

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Mining Stocks

Week Ended January 17, 1925

Mining stock quotations for week ended Jan. 10 appear on the preceding page

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb			*6		
Anaconda	New York	48	45⅝	46	Ja.17, Fe.16,	0.75
Arcadian Consol.	Boston	3	2⅞	2⅞		
Ariz. Com'l.	Boston	14⅞	14⅛	14⅛	Ja. 19, Ja. 31	0.50
Calaveras	N. Y. Curb	1⅞	1⅞	1⅞		
Calumet & Arizona	New York	57⅜	55½	55½	De.5, De.22 Q	0.50
Calumet & Hecla	Boston	18⅛	17⅝	17⅝	June 1924	0.50
Canario Copper	N. Y. Curb	4½	4	4½		
Cerro de Pasco	New York	55	53⅜	54⅛	Ja. 22, Fe. 2, Q	1.00
Chile Copper	New York	37⅛	35⅜	36⅛	De.3, De.29, Q	0.62½
Chino	New York	26⅞	25⅝	25⅝	Sept., 1920	0.37½
Con. Coppermines	N. Y. Curb	3 13/16	3 5/16	3 5/16		
Copper Range	Boston	32¼	30⅝	31¼	May, 1924	1.00
Crystal Copper	Boston Curb	*59	*54	*55		
Davis-Daly	Boston	*72	*67	*68	Mar., 1920	0.25
East Butte	Boston	5⅞	5¼	5½	Dec., 1919	0.50
First National	Boston Curb	*41	*34	*34	Feb., 1919	0.15
Franklin	Boston	*75	*60	*70		
Gadsden Copper	Boston Curb	*85	*65	*84		
Granby Consol.	New York	21⅛	19⅛	19⅞	May, 1919	1.25
Greene-Cananea	New York	19⅛	18⅛	18⅛	Nov., 1920	0.50
Hancock	Boston	1⅛	1⅛	1⅛		
Howe Sound	N. Y. Curb	3⅜	3⅜	3⅜	April 1924	0.05
Inspiration Consl.	New York	32⅞	30⅛	31	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb	3½	2	2	May, 1923	0.15
Isle Royale	Boston	20	18⅛	18⅛	Sept. 1923	0.50
Jerome Verde Dev.	N. Y. Curb	1	*98	1		
Kennecott	New York	57¼	55	56	De.2, Ja.2, Q	0.75
Keweenaw	Boston	1⅛	*99	*99		
Lake Copper	Boston	3	3	3		
Magma Copper	New York	44⅛	41½	41⅞	Jan., 1919	0.50
Mason Valley	N. Y. Curb	2⅝	2⅛	2⅜		
Mass Consolidated	Boston	1⅛	1⅛	1⅛	Nov., 1917	1.00
Miami Copper	New York	24⅜	23⅛	23⅝	Fe.2 Fe.16 Q	0.50†
Mohawk	Boston	40	38	38	Se. 22, Oc. 13	1.00
Mother Lode Coa.	New York	9	8⅛	8⅛	De. 12, De. 31	0.37½
Nevada Consol.	New York	15⅞	15⅛	15⅛	Sept., 1920	0.25
New Cornelia	Boston	24½	23⅞	23⅞	No. 7, No. 24	0.25
New Dominion	N. Y. Curb			2⅜		
North Butte	Boston	3⅛	2⅞	3⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	1 1/16	1⅛	1¼	No.14, De.2	0.05
Old Dominion	Boston	27	24	25	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†120			De.2, Ja.2 Q	1.00
Quincy	Boston	38	33⅛	33⅛	Mar., 1920	1.00
Ray Consolidated	New York	16	15⅛	15⅜	Dec., 1920	0.25
Ray Hercules	N. Y. Curb	*16	*13	*14		
St. Mary's Min. Ld.	Boston	48	44½	44½	May 1924	3.00
Seneca Copper	New York	1⅛	1	1		
Shannon	Boston	1⅛	1⅛	1⅛	Nov., 1917	0.25
Shattuck Arizona	New York	7⅛	7⅛	7⅛	Jan., 1920	0.25
Superior & Boston	Boston	2⅛	1 7/16	2⅛		
Tenn. C. & C.	New York	9⅛	8⅛	8⅞	De.31, Ja.15,Q	0.25
United Verde Ex.	N. Y. Curb	29⅛	28⅛	28⅛	Ja. 2, Fe. 2	0.50
Utah Copper	New York	92	88	91	De.12, De.31,Q	1.00
Utah Metal & T.	Boston	*86	*50	*85	Dec., 1917	0.30
Victoria	Boston			*85		
Walker Mining	N. Y. Curb	3⅛	3⅛	3⅛		
Winona	Boston	*40	*25	*27		
NICKEL-COPPER						
Internat. Nickel	New York	26⅛	25⅛	26⅜	March, 1919	0.50
Internat. Nickel pfd.	New York	97	95⅜	97	Ja. 15, Fe. 2, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	6	4⅜	5⅞		
National Lead	New York	164⅞	158	161¼	De.12, De.31, Q	2.00
National Lead pfd.	New York	116½	116⅛	116⅜	Fe.2, Mh.14, Q	1.75
St. Joseph Lead	New York	45	42⅜	43⅛	De. 9, De. 20	0.50
ZINC						
Am. Z. L. & S.	New York	12¼	10⅞	10⅞	May, 1920	1.00
Am. Z. L. & S. pfd.	New York	38⅜	36	36	Nov., 1920	1.50
Butte C. & Z.	New York	8⅛	8	8⅛	De.10, De.24	0.50
Butte & Superior	New York	23⅝	22	22⅛	June, 1923	0.50
Callahan Zn-Ld.	New York	4½	4⅛	4⅛	Dec., 1920	0.50
New Jersey Zn.	N. Y. Curb	195	189	194⅜	Ja.20, Fe.10	2.00
United Zinc	N. Y. Curb			*15		
Yellow Pine	Los Angeles	*80	*75	*75	De.10,De.15 Q	0.04
SILVER						
Alvarado	Boston Curb	1⅛	1⅛	1⅛	Oct. 1920	0.50
Beaver Consol.	Toronto	*34	*30¼	*33	May, 1920	0.03
Castle-Trethewey	Toronto	*79⅜	*74	*79½		
Coniagas	Toronto	2.20	2.17	2.18	May, 1924	0.12½
Keeley	Toronto	2.18	2.15	2.17	Sept. 15, SA	0.12
Kerr Lake	N. Y. Curb	1¾	1⅝	1⅝	Oc. 1, Oc. 15,	0.12½
La Rose	Toronto	*16	*13½	*15	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1.35	1.30	1.34		
McKinley-Dar.-Sav.	Toronto	*19½	*14	*19¼	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.08	2.80	3.00	Sept., 1919	0.12½
Nipissing	N. Y. Curb	6¼	6⅛	6⅛	Ja.18,Ja.20,QX	0.30
Ontario Silver	New York	6	6	6	Jan., 1919	0.50
Temiskaming	Toronto	*30	*26	*26	Jan., 1920	0.40
GOLD						
Alaska Gold	New York	*37½	*20	*25		
Alaska Juneau	New York	1⅛	1	1		
Argonaut	Toronto	*36	*30½	*35½		
Carson Hill	Boston	*65	*50	*50		
Consol. W. Dome L.	Toronto	*19	*17½	*18½		
Cresson Consol. G.	N. Y. Curb	3⅞	3⅛	3⅛	De.31, Ja.10 Q	0.10
Crown Reserve	Toronto	*53	*48½	*52	Jan., 1917	0.05
Dome Mines	New York	16¼	14½	16¼	De.31, Ja.20, Q	0.50
Golden Cycle	Colo. Springs	1.48	1.42	1.48	Dec.11, 1924	0.03
Hollinger Consol.	Toronto	14.95	14.70	14.90	Ja.12, Ja. 28, M	0.05
Homestake Mining	New York	50	48	48	Ja.20,Ja.25,MX	1.50
Jib, Cons'l.	N.Y. Curb	*61	*50	*52		
Kirkland Lake	Toronto	*47	*51¼	*40		
Lake Shore	Toronto	4.95	4.80	4.87	De.1, De.15,XQ,	0.10
McIntyre-Porcupine	New York	16¾	16½	16½	Fe.2, Mh.2,	0.25
Newray	Toronto	*29	*27	*28		
Night Hawk Pen.	Toronto	*30	*25	*25		
Portland	Colo. Springs	*42½	*40	*42½	Oct., 1920	0.01
Rand Mines	New York			35¼	Aug. 1924	1.71
Teck-Hughes	Toronto	1.37	1.30	1.35		
Tom Reed	Los Angeles	*39	*37	*37	Dec., 1919	0.02
Tough-Oakes	Toronto	*42½	*39	*42		
United Eastern	N. Y. Curb	*39	*39	*39	July, 1924	0.05
Vipond Cons.	Toronto	1.40	1.32	1.39		
Wright-Hargreaves	Toronto	4.40	4.28	4.35	De.15, Ja.2,QX	0.05
GOLD AND SILVER						
Black Oak	N. Y. Curb			*81		
Con. Cortez	N. Y. Curb	*10	*10	*10		
Con. Virginia	San Francisco	7½	6½	6½		
Continental Mines	N. Y. Curb			1½		
Dolores Esperanza	N. Y. Curb			*26	July, 1923	0.05
Premier Gold	N. Y. Curb	2 3/16	2⅛	2⅛	De.22, Ja.5,QX	0.10
Tonopah Belmont	N. Y. Curb	*55	*55	*55	Apr., 1923	0.05
Tonopah Divide	N. Y. Curb	*27	*26	*27	Se. 22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	3 1/16	3	3	De.11, Ja.1	0.05
Tonopah Mining	N. Y. Curb	1⅞	1 7/8	1 7/8	Se.20, Oc.31	0.07½
Unity Gold	N. Y. Curb	*77	*77	*77		
West End Consol.	N. Y. Curb			*16	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	*40	*40	*40	June, 1918	0.02
SILVER-LEAD						
Ahumada	Boston Curb	10⅛	10⅛	10⅜	De.15, Ja.2, X	0.15
Bingham Mines	Boston	33	30⅞	32⅛	De.20, Ja.2	0.50
Cardiff M. & M.	Salt Lake	1.20	1.10	1.10	De.16, No.18	0.10
Chief Consol.	Boston Curb	3¾	3⅜	3⅜	May, 1924	0.10
Columbus Rexall	Salt Lake	*24	*21	*21	Aug., 1923	0.05
Daly Mining	Salt Lake			1.50	July, 1920	0.10
Erupcion	Boston Curb	3⅝	3	3⅜	De.15, Ja.2, X	0.15
Federal M. & S.	New York	25½	23	23⅛	Jan., 1909	1.50
Federal M. & S. pfd.	New York	64½	61⅛	61⅛	No.25, De.15,	1.75
Florence Silver	Spokane	*8⅛	*6½	*6½	Apr., 1919, QX	0.01
Hecla Mining	N. Y. Curb	14⅞	13⅛	14⅛	No.15, De.15	0.25
Iron Blossom Con.	N. Y. Curb			*26	Oc.25, 1924	0.02½
Marsh Mines	N. Y. Curb			*6	June, 1921	0.02½
Park City	Salt Lake			5	De. 15, Ja.4	0.15
Park Utah	Salt Lake			3⅛	April, 1924	0.15
Prince Consol.	Salt Lake	*30	*20	*30		
Silver King Coal	Salt Lake	6.00	5.85	5.85	De.20, Ja.2, Q	0.50
Silversmith	Spokane	*28	*26	*27⅜	Ja. 1, Ja. 10	0.02
Tamarack-Custer	Spokane	*93	*75	*91	Se. 22, Se. 29	0.25
Tintic Standard	Salt Lake	9.05	9.00	9.05	Ja.2, QX	0.50
Utah-Apex	Boston	5 1/16	4⅛	5 1/16	Ja.10, Ja.15,	0.25
IRON						
Bethlehem Steel	New York	53½	50½	51⅜	Jn.1, Jy.1, Q	1.25
Char. Iron	Detroit	*20	*17	*20		
Char. Iron pfd.	Detroit			*74		
Colorado Fuel & Iron	New York	48¼	42⅜	45⅜	May, 1921	0.75
Gt. North'n Iron Ore	New York			108½	De.10, De.27	2.00
Inland Steel	New York	47	45⅜	46	De. 1924, Q	0.625
Mesabi Iron	N. Y. Curb	4⅜	4	4⅛		
Replogle Steel	New York	23½	20⅛	21¼		
Republic I. & S.	New York	63⅜	57⅛	61	May, 1921	1.50
Republic I. & S. pfd.	New York	95	93½	94	De.16, Ja.2, Q	1.75
Sloss-Sheffield S. & I.	New York	86½	83	86	Dec., 1924 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	96½	96	96½	De.20, Ja.2, Q	1.75
U. S. Steel	New York	125⅜	122⅛	125⅛	No.29,De.3, QX	1.75
U. S. Steel pfd.	New York	124	123	123⅛	No.4, No.29, Q	1.75
Virginia I. C. & C.	New York			43⅛	De.15, Ja.2	1.50
Virginia I.C.&C.pfd.	New York	79⅛	79¼	79½	De. 13, Ja. 2, Q	2.50
VANADIUM						
Vanadium Corp.	New York	31⅛	28	29⅜	Jan., 1921	1.00
ARSENIC						
Western Utah Copper	N. Y. Curb	*24	*20	*24		
ASBESTOS						
Asbestos Corp.	Montreal	38	38	38	Oct., 1924 Q	1.00
Asbestos Corp. pfd.	Montreal	76	74	76½	Ja.2, Ja.15, Q	1.50
SULPHUR						
Freeport Texas	New York	11	10	10	Nov., 1919	1.00
Texas Gulf	New York	106½	101⅜	105	De.1,De.15, QX	2.25
DIAMONDS						
De Beers Consol	New York			23¾	Ja.6, Fe.2	0.95
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3⅛	3⅛	3⅛		
MINING, SMELTING AND REFINING						
Amer. Metal	New York	52⅛	50⅛	51	No.19, De.1 Q	0.75
Amer. Metal pfd.	New York	116	116	116	No.20, De.1, Q	1.75
Amer. Sm. & Ref.	New York	110	108	110	Ja.16, Fe.2, Q	1.50
Amer.Sm.&Ref.pfd.	New York	145	144	144	Fe.6, Mh.2 Q	1.75
Consol. M. & S.	Montreal	52⅜	48	52⅛	De.11, Ja.15 SA	0.75
Federated Metals	N. Y. Curb			37½		
Southwest Metals	N. Y. Curb			2		
U. S. Sm. R. & M.	New York	39	37	37⅛	Jan., 1921	0.50
U.S. Sm. R.&M.pfd.	New York	46⅜	45¼	45⅜	Ja.8, Ja.15	0.87½

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