

ENGINEERING AND MINING JOURNAL-PRESS

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



DRILLING a round with auger drills in soft iron ore in the Danube mine on the Mesabi in northern Minnesota. Though introduced on the range but a few years ago, this type of machine is being increasingly used wherever the ground permits

Natural History of the Pegmatites

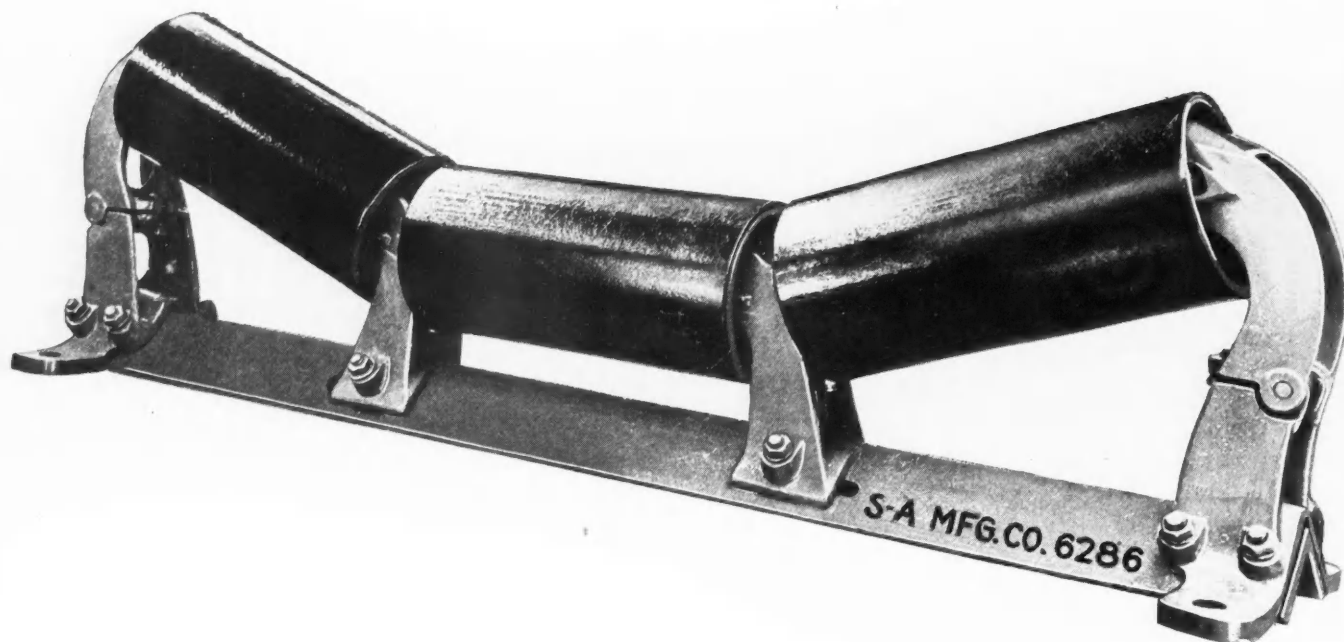
By Frank L. Hess

A Proposed Method for Caving Oil Shale

By Fred Carroll and G. R. De Beque

Tintic Standard's Reduction Plant

By Arthur B. Parsons



This Carrier Sets a New Standard

This straight-line, three-pulley, anti-friction type Carrier fills a definite position in the schedule of superior belt conveyor Carriers built by S-A Engineers.

Mechanical features of this Carrier command consideration by operating men who measure the value of a Carrier by ultimate satisfaction and cost of service per ton handled.

Write for Bulletin No. 143

STEPHENS-ADAMSON MFG. CO.

Aurora, Illinois

SACCON CARRIER

ENGINEERING AND MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

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Value of Mining Stock

THE Engineer Gold Mines, Ltd., owns sundry leases and options on a property situated in British Columbia, 25 miles from Atlin. According to reports, several hundred thousand dollars worth of bonanza gold ore was shipped from surface cuts and a 235-ft. shaft by the owners some years ago. The present lessees started development late in 1924. They have built a 300-hp. hydro-electric plant, 5 miles from the mine, and a 100-ton mill. They have driven a crosscut tunnel to tap the veins at a depth of 250 to 500 ft. The mine is stated to be fully equipped for production as soon as sufficient faces can be opened up. One of the veins contains a 1-in. band of ore that assays \$8 per pound. This is very rich ore. A ton of it would bring \$16,000 if it could be sorted out and shipped. A fair description of this property would seem to be to say that the ore is "spotty" but rich, and that the development is limited. If there are not enough faces to start milling on a scale of even 25 tons per day—which ought to be profitable if the ore approaches the richness that is intimated—there certainly is much to do before the property can be called a mine. It is today a good prospect. But to give it the benefit of the doubt, suppose it be called an exceptionally valuable prospect.

The shares of the Engineer Gold Mines, Ltd., were quoted on the New York Curb market at \$109 in July and sales were made at that level, according to the record. There have been issued 200,000 shares of stock, making the "apparent" value of the property on the basis of these sales \$21,800,000.

What were some of the world's greatest gold mines worth at the time they started production? The Homestake mine in South Dakota had produced \$188,419,335 on Jan. 1, 1924. Total dividends to that date were \$45,310,684, paid with great regularity since January, 1879, except for short periods when mine fires and labor troubles interfered. Roughly, the dividends were \$1,000,000 a year for the 45-year life of the mine. The present worth of an annual dividend of \$1,000,000 for 45 years at 9 per cent interest with the replacement of capital by reinvestment at 4 per cent at the beginning of the period is \$10,200,000. Even if it had been known for certain that the Homestake would continue to earn at a high rate for 45 years, the mine in 1879 would have been worth only \$10,200,000.

A more nearly comparable case, in that the ore was extremely high grade, might be that of the Goldfield Consolidated in Nevada. The company was incorporated in 1906, but dividends did not commence until 1909. The biggest dividends came in 1910, 1911, and 1912; in 1916, 1917, and 1918 nothing was paid, but another dividend was distributed in 1919. The total is \$29,176,788. In round numbers, \$2,900,000 per year was paid in the 10-year period following 1906. On that basis the value of the property would have been

\$16,733,000 in 1906, if it could have been foreseen that the mine would produce more than \$50,000,000 in the brief span of ten years. The reason for the fact that the Goldfield Consolidated was of greater worth than the Homestake was the comparative higher rate of production. The proceeds of early years are far more valuable than those of the subsequent ones.

When the Goldfield Consolidated Mines Co. was organized, many thousands of feet of development work had been done in five separate mines, the production of which already had reached several millions. Real mines, not prospects, were taken into the consolidation, but even so the production that subsequently was realized exceeded anything that was expected in 1906. The Engineer mine may some day become a large producer of gold, but it will have to be bigger and better than the Homestake or the Goldfield Consolidated to return to the people who pay above \$100 for shares a 9 per cent return on their investment.

If the public will not risk its money to finance the search for ore, mines will not be developed; no reasonable observer opposes that kind of speculation. On the other hand, the chance that the prospect owned by the Engineer Gold Mines, Ltd., will develop into a property a third again as productive of dividends as the Goldfield Consolidated is so remote that no sane and well-informed person would speculate on it.

Engineering Program at Stanford

THE new engineering curriculum initiated at Stanford is based upon a six-year program comprising three two-year periods. The first four years is to be undergraduate work restricted to science and cultural subjects, and the post-graduate work is to be an intensive study of engineering theory and practice. The plan puts into practice ideas that have been largely formulated by mature discussion of the educational requirements of modern engineers. It aims at the subordination of the practical and the development of a more efficient theoretical training based upon the requirements that professional men must meet in a life of conspicuous leadership.

Mining education arose in response to a need for particular knowledge of minerals, rocks, assaying, sampling, mine operation, and many other details, including ore treatment. The first work of the mining schools was therefore specific in respect to these subjects. Necessarily there had to be more or less of a background of chemistry, mathematics, and physics, and these subjects invariably formed part of the curricula. The educational work was practical and dealt with the objective. A student could more or less readily identify a mineral or a rock and could make quantitative determinations. He could survey, and make a map and a working drawing. He was fairly well equipped with a stock of mining, geological,

hydraulic and electrical information. The sounder schools stressed the desirability of broad fundamental training and superimposed as much of this as they dared. Thus through a period of years practical objective training went hand in hand with theory. This is on the whole an excellent outcome for ordinary mortals, especially of the bread-and-butter variety. It made it possible for a graduate to get a job, and if he had initiative and was observing enough he could and did advance to higher positions. This advance from subordinate to executive positions was determined largely upon the internal development of the man stimulated by personal ambition.

The status of the mining industry has changed greatly since the days of the placer miner and the Comstocker. The familiar elemental principles still exist, but in addition are many complex features that involve economic, sociological, managerial, and political phases of industry. Large company organizations covering groups of mines and spreading out into foreign countries are characteristic of these times. The scale of operations has increased. The industry has ramified into manufacturing. Systematic marketing and distribution have elbowed out the old take-it-or-leave-it policy of bygone days. Government regulation and federal taxation have interposed additional complications. The present-day mining executive must therefore be prepared to handle not only technical details but also a business of large proportions that has to do with the skillful management of labor. He must be prepared to initiate research with the objective of improving methods and standards. He must also be prepared to protect his business and to see that it gets a square deal in the maze of laws that affect industry.

Competent leadership and management are of fundamental importance in the success of mining and industrial enterprises. It is therefore not surprising that educational institutions should seek to turn out a better product. Whether the new path indicated by theoretical considerations will do the trick any better than has been done by industry as in the specific case of mining is debatable. Educational plans such as Stanford's are clearly experimental, as was demonstrated by similar attempts at Columbia University, which were not especially successful. Will the industries be eager to take the new product? Undoubtedly the more conservative business organizations will insist that the potential leaders qualify their ability by demonstrating how well they can handle simple problems. Given the proper material, executive ability can undoubtedly be developed by the universities. Undoubtedly selection will have to be rigorous, else the highly intensive effort will be dissipated. Universities will therefore split into two groups, one of which will apply principles of intensive education to a selected few, leaving the other group in the same status as it is at present.

Duluth the Magnet of the North

A BAR OF IRON surrounded by a coil of copper wire through which a current of electricity passes becomes a magnet. Duluth, surrounded by immense deposits of iron ore into which the energy of the prospector, the skill of the engineer, and the patience of the metallurgist have been injected, has become the financial magnet of the North. Duluth

occupies a peculiar strategic position in that it is both an importing and an exporting port on an inland sea. Duluth exports from the northland fabulous tonnages of iron ore, immense quantities of wheat, and millions of feet of lumber. It imports coal, structural steel, foodstuffs, and a thousand manufactured articles, and in turn sends them on to the land of wheat, iron, and lumber in exchange for these raw materials. Duluth is the gateway between the East and the West, and by reason of her natural resources has attracted capital in untold millions both in construction of railroads and terminals and fleets of ships for the transportation of her ores, lumber, and wheat. Fifty years of progress has built up a city second only to New York in the amount of freight handled each year. It is, therefore, befitting that her semi-centennial should have been marked by a special celebration in which the basic industries of the Northwest participate. With refinement in engineering and metallurgical processes there does not seem to be any reason for undue alarm as to the condition of this city when the centennial rolls around. Is it not possible that Vulcan will remove his fiery throne from his Eastern provinces to the head of the Great Lakes?

Complex Tax Laws and Fraud

SOME TIME AGO a suave gentleman, having gained a confidential interview with the president of a well-known Western mining company, presented in substance the following proposition: "On the desk of a certain examiner in the income tax unit of the Bureau of Internal Revenue in Washington is a memorandum indicating that a review, in the light of new interpretations of the statute, of your company's tax return for 1917 shows that you still owe the government \$324,365.17. [For obvious reasons the real figure is not given, but this will serve.] Within a few weeks you will be notified to this effect. The firm I represent is prepared to undertake the presentation of your case on a contingent fee basis, with every assurance that at least \$275,000 of this additional tax can be removed. Two of the members of the firm were connected with the Internal Revenue Bureau for several years, and by virtue of this fact they not only are thoroughly familiar with the regulations and know the requirements of a properly prepared brief, but are able to gain the sympathetic attention of the present officials."

This company had agreed with the Treasury officials as to the correct amount of the tax for 1917 and had settled in full. The hard-headed president briefly told his visitor that the company's regular attorneys would handle the matter and ended the interview. As predicted, the statement of additional tax arrived, and the amount was \$324,365.17! Protests were filed and the case is still pending.

The above story is a true one, as reported to us directly by the official who had the experience, but who does not desire that his name or that of his company appear. Other companies, we are reliably informed, have found themselves in a similar predicament and have taken the alternative of accepting the proffered service, preferring to employ someone who was on the "inside" rather than go again through the almost endless task of adjusting taxes under a law that is much too involved and vague for exact interpretation. Their

cases have been settled promptly according to the promises of the special pleaders; and fat fees have been paid.

These experiences reveal a state of affairs that is inimical to the government and to the corporations. They are made possible by a law that is too complex and involved to permit of intelligent interpretation. So long as two returns, diverging by hundreds of thousands of dollars, can be defended reasonably under one law, that law is at fault. The law should be simpler, and it should leave less to the discretion of the individual making or examining a return. These requirements may seem paradoxical. But until such a law is drawn or income taxes are abolished the opportunity for fraud will be too much of a temptation for the average man in the Bureau of Internal Revenue.

The Glory Hole Mining Method

THE COMBINATION of a conical-shaped pit, a vertical ore transfer terminating in a chute gate and an adit, or a drift connecting with a shaft, represents the essential elements in the glory hole mining method, which originated long ago in mining practice. Systematic application of the method is conspicuous in modern mining where the ore occurrence presents favorable physical features. Its simplicity and the fact that, by its adoption, mechanical loading equipment can be avoided are the chief advantages. The iron ore miner and the metal miner generally have made extensive use of the method. As applied to limestone and other non-metallic mineral quarries, the method has resulted in more economical working and simplification of mechanical installations. This has enlarged the possibilities of such deposits.

Glory hole mining is inapplicable to flat-bedded deposits unless they are of unusual thickness. Its principal field is in the mining of lenses and on-end deposits that are of considerable width. Important exemplifications of the method have appeared in the *Mining Journal-Press* at different times. Thomas C. Baker's article on the practice at Fresnillo and R. A. Kinzie's description of limestone quarrying at Davenport, Calif., are mentioned in particular as indicating the possibilities of glory hole mining when systematically applied. The experience of the underground miner has been of great service in developing the details of the method.

A Remarkable Gold-Producing Area

IN THE Witwatersrand Goldfield of the Transvaal area, the gold mines produced and milled 26,538,875 tons in 1923 from thirty-nine separate properties. The gold production was 8,904,401 oz., or a yield of \$6.88 per ton. Working costs averaged \$4.86 per ton; operating profits, \$1.99; and dividends, \$1.54 per ton. The average production per mine was 680,484 tons. Assuming a stoping width of 5 ft., the stoping area corresponding is equivalent to 1,523 acres, or 2.22 square miles. Since 1884, when mining was started in this remarkable area, the mines have produced 477,587,518 tons (this total to the end of 1923 is not complete, as certain records are missing) and a total gold yield of 172,552,466 oz. On the basis of a stoping width of 5 ft., the corresponding stoping area equals 27,409 acres, or 42.8 square miles. This is all the more noteworthy when it is considered that relatively narrow veins are mined at a depth ranging to 5,000 ft. or more.

On the basis of the computed area, the yield per acre was approximately 6,300 oz. of gold. The extent to which systematic mining has progressed may be visualized by the fact that the volume represented by the ore mined in thirty-nine years is approximately equivalent to a cube 1,800 ft. on an edge.

The economic significance of the gold miner's activities as a factor in the life of modern times is often not fully appreciated. In this instance, apart from the release of enormous wealth that maintains finance on a stable basis, the money distributed to labor, to supplies, and to manufacturers of mining equipment, in the aggregate runs into several billions of dollars. Every gold-mining area thus becomes the focus for the distribution of wealth which permeates the whole industrial fabric. Dividends are reinvested in diverse enterprises that play their part in affording opportunity for employment. The lure of gold is the superficial appeal. The release of fluid wealth is the significant factor that spins the wheels of industry and widens the opportunities for everyone. Gold does not stay put. Mere gold is of little economic significance, but the labor and energy input represented by this gold is the important vitalizing force. It represents energy that can be transferred from place to place and from one time to another.

Ore-Leaching Principles

IN A RECENT ARTICLE in *Chemical & Metallurgical Engineering*, Arthur W. Allen presented an important discussion of principles affecting leaching practice. As ore leaching, especially in its applications to low-grade oxidized copper ores, is increasing in importance, it is essential for the copper technologist to review the fundamentals of the subject. The proportion of metal removed to the whole ore is small and therefore shrinkage or consolidation of vat charges is negligible. Where the ore is porous and extraction can be obtained from coarse particles, bulk leaching, especially if large tonnages are handled, is comparatively easy, as the effect of variation in particle size, and as a result of segregation, is distributed and the charge is such that high permeability rules rather than otherwise.

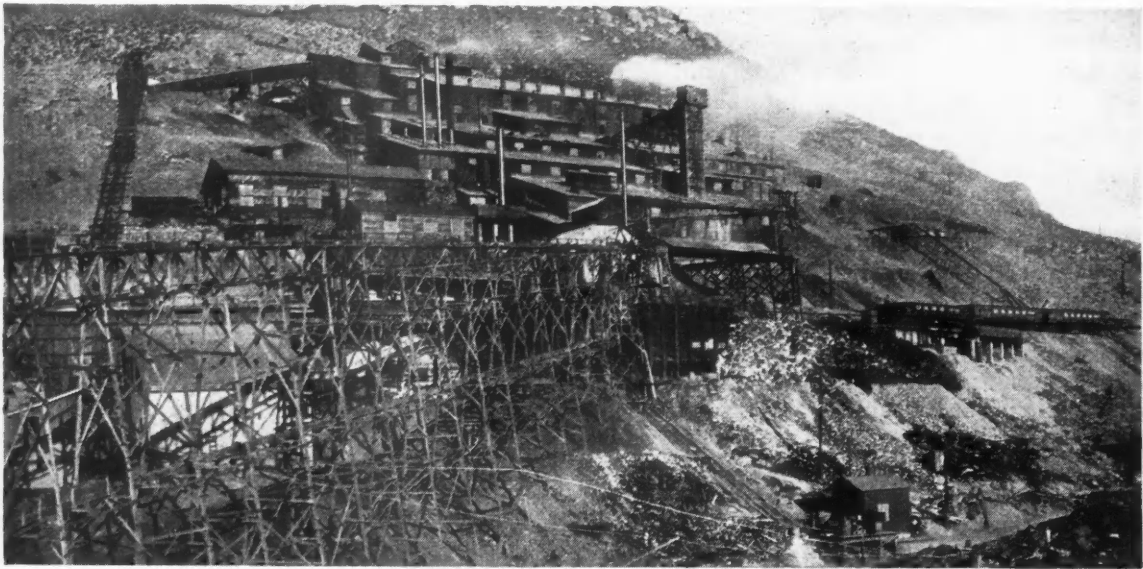
With less permeable ores and ores characterized by a considerable proportion of slime or colloidal content, segregation of vat charges (primarily caused by uneven distribution in charging) becomes of importance. Unnecessary crushing, once a maximum particle size has been decided upon, is to be avoided, and this can be done only by careful selection of crushing machines and conscientious screening. Dry charging of vats may result in segregation with resultant effect upon the permeability of the vat charge. Mr. Allen directs attention to the uniform moistening of the ore before charging as a method of overcoming segregation. He also points out the fact that heating to certain temperatures has the effect of rendering colloidal slime non-plastic. The use of hot solutions, which in certain cases causes flocculation of slime particles, is another aid to maintaining permeability. The important point in the case of ores of low permeability is uniform vat charging. Given this condition, the solution of the ore minerals is a function of the solvent used, its strength, temperature, movement, and the time permitted. Without a proper charge condition, the metallurgic results are apt to be unsatisfactory.

The Tintic Standard Reduction Plant

Brine Leaching Follows Chloridizing Roast—Holt-Dern Furnace Is Feature—Marked Increase in Recovery Obtained by Improved Technique

By Arthur B. Parsons

Assistant Editor



Chloridizing roast and brine leaching plant of the Tintic Standard Mining Co.

The coarse crushing unit is behind the tailing trestle in the foreground. Ore is shipped thirteen miles from the mine at Dividend in the East Tintic district

THE TINTIC STANDARD MINING CO. has the distinction of operating at Harold, Utah, the only plant in North America that is equipped to produce fine silver bullion, merchantable pig lead, and a rich copper precipitate directly from ore by hydrometallurgical methods. The process, chloridizing roasting followed by acid-brine leaching, is similar to that formerly used by the Tintic Milling Co. at Silver City in a plant that is now dismantled. The experimental work on which was based the design of the Tintic Standard plant was done by Theodore P. Holt, superintendent of operations at Silver City, who, with George Dern and Neils C. Christensen, was largely responsible for the modern development of the process and its application to Utah ores. Essentially the treatment is similar to that of the Longmaid-Henderson process used in both England and Germany as long ago as 1849. An important feature of the present operation is the use of the Holt-Dern blast roaster, a furnace specially designed to accomplish the chloridizing roast. The builders of the Tintic Standard plant had full advantage of the experience of Mr. Holt and his associates at the Silver City plant, so that the former is in many respects more advantageously designed.

RECOVERY OF LEAD GREATLY INCREASED

Moreover, various improvements in practice have been made in the last two years, particularly with respect to lead. At the start the recovery of the lead was to be incidental, as it was at Silver City; but, stimulated

by the higher prices for the metal, effort has been devoted to improving the recovery and the grade of the precipitate.

The ore that is treated in the plant ranges in analysis approximately as follows:

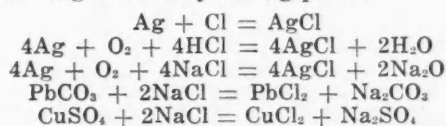
Silver, oz.	12.0 to 20.0	Iron, per cent . . .	4.0 to 10.0
Gold, oz.	0.02 to 0.03	Sulphur, per cent.	2.5 to 4.0
Lead, per cent. . .	2.0 to 6.0	Lime	0.25 to 0.4
Copper, per cent. .	0.3 to 0.5	Zinc	0.1 to 0.15
Insoluble, per cent.	65.0 to 75.0	Arsenic	0.60 to 0.75

Essential requirements for the process are that the gold content of the ore shall be low, because the percentage recovery of gold is very small; that the sulphur content shall be less than 4 per cent to obviate sintering in the roasters and consequent difficulties that I shall mention later; and that the lime content be low. Carbonates consume acid and they probably act as dechloridizing agents in the roast and in consequence reduce the recovery of the metals. In general, depending on the price of metals, wages, cost of supplies, and other variables, the plant cannot successfully compete with shipment to the smelter when the ore contains more than 39 oz. silver. With silver selling at 65c. per ounce and lead at 8c. per pound, ore containing 20 oz. silver and 4 per cent lead will net 91c. per ton more to the company if treated at its own plant than if shipped to the smelter.

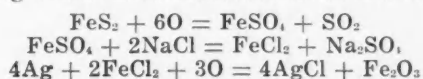
The essentials of the process may be described briefly as follows: The ore is crushed and ground, dry, to

6 or 8 mesh with 10 per cent crude salt. From 1 to 2 per cent powdered coal, the amount depending on the sulphur content of the ore, is then added. This mix, dampened with 6 to 7 per cent water, is the blast roaster feed. The roasting is done in charges or batches, the chloridized product being shaken through the grates.

The chemical reactions are many and complex, some of the following ultimately taking place:



The presence of pyrite assists materially in the chloridizing of silver as indicated in the following:



The advantages of the Holt-Dern roaster are various. If the moisture content of the mixture is properly regulated, the damp material forms a blanket of gradually decreasing thickness, which confines the heat of combustion in the roasting zone and minimizes the loss of metals through volatilization and dusting. The resulting product, under proper conditions, is thoroughly and uniformly chloridized, is porous, and is in excellent physical condition for subsequent leaching. Moreover, the cost of the operation is very low.

The chloridized calcine is sluiced with weak solution to concrete tanks provided with gravel filter bottoms, where it is subjected to a five-day percolating leach with hot acid-brine solution. After washing, the residue is discharged.

The pregnant liquor may carry gold, silver, copper, lead, antimony, iron, alumina, and zinc, depending on the character of the ore. Silver is precipitated by

agitation with cement copper (part of the product obtained in the next step in the precipitation cycle); copper is precipitated on scrap iron; and the lead, after the temperature has been raised to 85 deg. C., is precipitated on detinned sheet iron scrap. The effluent solution from the "lead" boxes is returned for re-use.

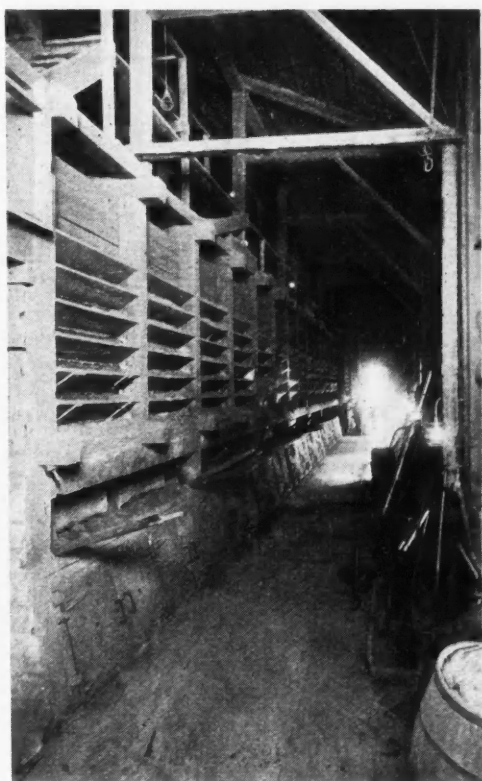
This general procedure is indicated clearly on the accompanying diagrammatic flow sheet. However, there are numerous details of equipment and manipulation that may be worth mentioning in view of the unusual character of the plant.

COARSE CRUSHING PLANT AT BOTTOM OF HILL

The site is an unusually steep hillside, the plant proper being entirely above the railroad tracks that serve it. The coarse crushing unit is at the bottom of the hill. It consists of a receiving bin, a 6-F Kennedy-Van Saun gyratory set at 3-in. and a Symons disk crusher set at $\frac{3}{4}$ in. Both ore and salt, of "crude smelter" grade, are crushed separately in these machines. A balanced-skip surface tramway run by a 75-hp. Westinghouse motor serves to hoist ore, salt, and coal dust to the top of the plant, where they are delivered to appropriate 90-ton bins by a Robins belt conveyor. Of the seven bins, five are for ore, one for salt, and one for coal.

Fine-grinding equipment consists of two sets of 16x48-in. Allis-Chalmers rolls and three Mitchell vibrating screens. The fine screens through which the material must all pass are 8-mesh, with No. 17 wire and an opening measuring 0.071 in. This gives a product of the size that experience has shown to be best.

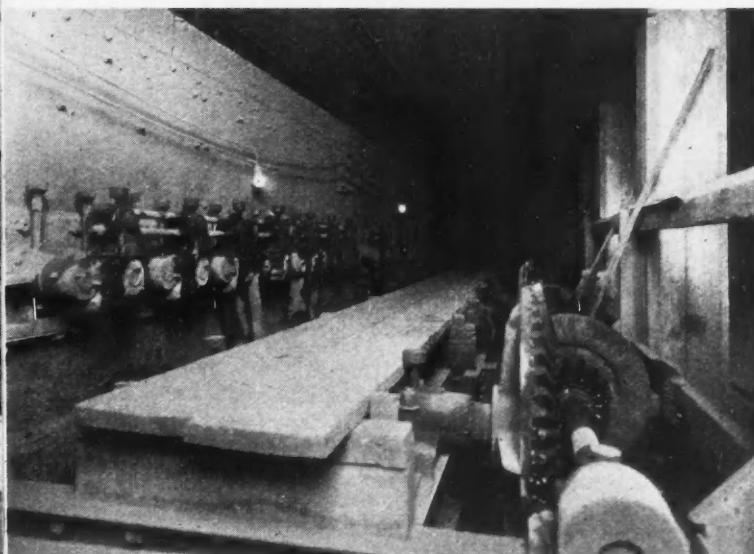
Ore and salt in proportion of 10 to 1 are mixed before entering the rolls, a composite sample being taken for each run of 75 tons which goes to a separate "fine" bin and constitutes a mill lot. Each lot is analyzed for metals and for sulphur, the latter being important,



Two views of the Holt-Dern furnaces

At the Left—Operating floor, showing the louvered feed bins above and the iron working doors just above the floor level.

At the Right—Just beneath the operating floor, showing the mechanism for shaking the grates.



as it regulates the quantity of coal that must be used. The ideal condition is to have 3 per cent sulphur (that is, "sulphide" sulphur, not absolute sulphur) in the ore, to which 30 lb. of coal per ton of charge is added, bringing the total fuel to the equivalent of 5.3 per cent sulphur. It would be easy to get 5.3 per cent sulphur in the ore, but that will not do, because excessive sulphides produce a more fusible charge with disastrous results. Sometimes two mill-lot bins may be drawn upon and mixed to get a better charge. Ordinarily, however, a 3,000-lb. charge is drawn from one bin into an electrically operated charge car the body of which is swung on a set of scales.

The charge car discharges into a No. 28 Smith belt-driven concrete mixer, to which the weighed coal is also fed. The mixture then passes through a pug mill, where the necessary water, 6 to 7 per cent, depending on the fineness of the ore, is added and further mixing is accomplished. The best condition is to have the ore-salt-coal mix just damp enough to adhere like molder's sand.

DESCRIPTION OF HOLT-DERN FURNACE

A system of belt conveyors delivers to the bins above the Holt-Dern roasters, of which there are nine set end to end. Essentially the furnace is a reinforced concrete box, 7x9 ft. and 6 ft. deep, equipped with special grates that can be mechanically shaken when desired. The iron working doors are 30 in. above the grate bars in the front of the furnace, and at the back is an opening 2 ft. square leading to the main flue that serves all the furnaces. One of the accompanying photographs shows the feed floor with the working doors below and the charge bins above. The other shows the shaking mechanism below the feed floor. Below the grates are the blast tuyeres and receiving hoppers for the finished calcine.

The roasting is done by charges, five tons to a charge and two charges to an 8-hr. shift. To a bed of about

10 in. of hot calcine from the previous charge a 30-in. layer of fresh mixture is added. An 8-oz. air blast is turned on and the roasting zone gradually rises from the bottom upward until the entire mass is roasted. The blast is shut off and the grates set in motion to shake the calcine into the hopper beneath. The crux of the entire process is the roast. If a satisfactory percentage of each of the valuable metals is chloridized, the leaching and precipitation can be effected and a good recovery obtained.

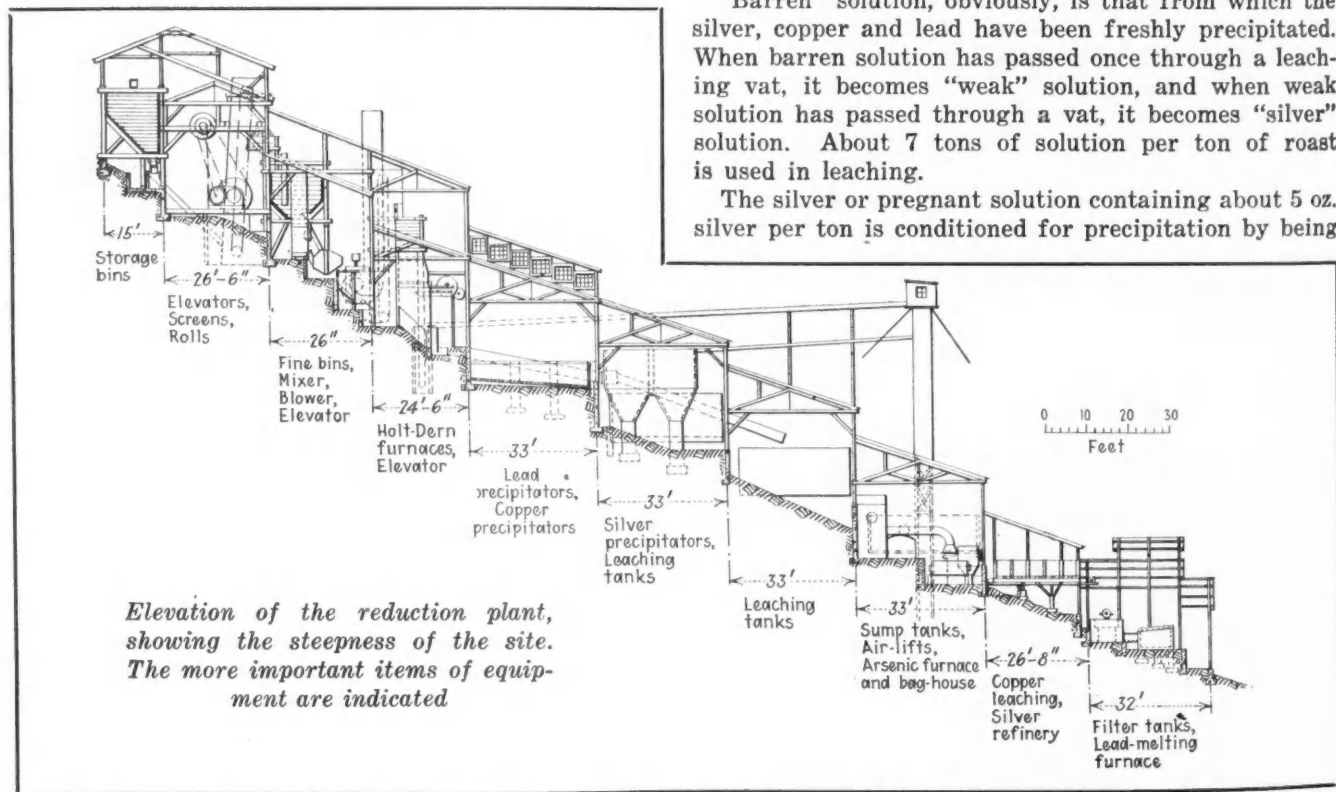
While still hot, the calcine is sluiced with strong brine solution to the particular leaching vat that is being charged. This solution in plant parlance is designated as "weak" because it is low in silver content. Sluicing has several advantages over charging dry. The avoidance of dusting and the utilization of the heat in the calcine for raising the temperature of the mill solution are the most important.

The leaching vats, six in number, are 28 ft. inside diameter, and 11 ft. deep, each holding about 225 tons of calcine. The leaching bottom is made of clean crushed quartzite in a skeleton-work of wood. This consists of triangular strips made by ripping 6x6-in. timbers diagonally. These are placed saw-tooth fashion on short pieces of 2x4-in. lumber lying on the bottom of the vat. The triangular strips are spaced about 1/4 in. apart and securely fastened. Above this is placed a checkerwork of 1x6-in. lumber set on edge, the squares being 2 ft. across. The whole is carefully filled with quartzite, starting with 3/4-in. pieces at the bottom and gradually decreasing to about 1/8 in. at the top. These bottoms provide a clear filtrate and several have given good service for more than a year. Vats are emptied of tailing by sluicing through bottom discharge gates, using 2 1/2-in. hose with water under 35 lb. pressure. The usual cycle, in hours, is as follows:

Filling	24	Wash	8
Weak solution leach	48	Draining	4
Barren solution leach	48	Sluicing	8

"Barren" solution, obviously, is that from which the silver, copper and lead have been freshly precipitated. When barren solution has passed once through a leaching vat, it becomes "weak" solution, and when weak solution has passed through a vat, it becomes "silver" solution. About 7 tons of solution per ton of roast is used in leaching.

The silver or pregnant solution containing about 5 oz. silver per ton is conditioned for precipitation by being



sprayed into an acid-absorbing chamber. This is simply a 40-ft. section of the roaster gas flue, 6x10 ft. in cross-section. Some hydrochloric and sulphuric are absorbed, but in addition commercial sulphuric acid (66 deg.) must be added. Total acidity as expressed in H₂SO₄ is maintained between 2 and 5 lb. per ton.

Air lifts with columns made of wood are used for pumping the hot corrosive solutions. Recently an acid-proof pump made by the Oliver Continuous Filter Co. has been tried with some success.

RUBBER LINING FOR LAUNDERS PROMISES ECONOMIES

Considerable improvement over the original wooden launders was effected by lining them with concrete reinforced with wire. Cracking caused considerable inconvenience, however, and a rubber lining is being tried for some of the launders with promise of material economy.

The precipitation of the silver with cement copper is accomplished in a set of four concrete agitators, each about 10 ft. square and 18 ft. deep, with hopper bottoms. Air lifts, similar to those used in a Pachuca tank, maintain the agitation, and a baffle or partition along one side of each provides a quiet settling column so that a fairly clear overflow may pass from each agitator to the next, or, in the case of the last, to the copper-precipitating vats. Originally the four were operated in series, the cement copper being added at the last agitator and working in counter-current fashion in the opposite direction from the solution. The present practice is to operate two units consisting of two agitators in series. When precipitation ceases in one unit, the entire flow is diverted to the other, the excess liquor is decanted off, and the precipitate is sluiced to the filter. This plan has resulted in a more complete displacement of the silver and has given a precipitate richer in silver. Re-solution of silver takes place when "ic" salts are present and metallic copper is not available to reduce them. When the copper content has been reduced to about 15 per cent, the remaining copper seems to be ineffective, probably because it becomes coated with arsenic. Accordingly, before this point is reached, it is advantageous to discontinue the flow and clean out the agitator.

A typical analysis of crude silver precipitate is:

Gold, oz.	0.005	Lead, per cent.	1.0
Silver, oz.	8031.6	Arsenic, per cent.	15.8
Copper, per cent.	15.0		

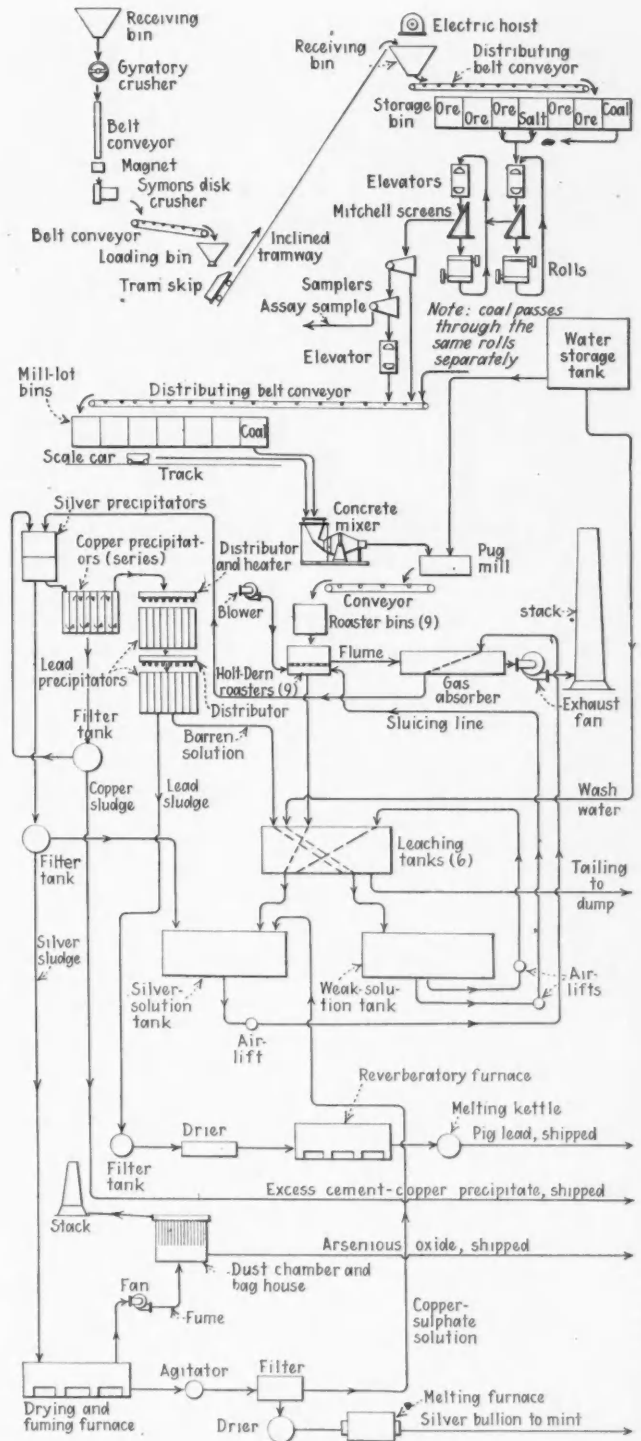
This precipitate in lots or charges is given a three-fold treatment in a small reverberatory furnace: (a) drying, (b) distillation of arsenic, which is caught in a small bag house and shipped as high-grade arsenious oxide, and (c) oxidation of the copper by roasting.

The copper is then leached out with sulphuric acid, leaving, after washing and filtering, a precipitate with the following analysis:

Gold, oz.	0.005	Lead, per cent.	1.8
Silver, oz.	15,385.0	Arsenic, per cent.	0.65
Copper, per cent.	1.1		

This precipitate is dried, fluxed and melted to bullion for shipment to the mint; or as an alternative it is merely dried and consigned to a custom smelter. The copper sulphate is returned to the leaching circuit with most beneficial results, as I shall explain presently.

To go back to the effluent from the silver precipitators: it is now ready to pass through the "iron boxes" for the precipitation of the copper and remaining silver. These consist of eight large reinforced concrete laun-



Flow sheet of the Tintic Standard plant

ders measuring 8x32 ft., with about 2 ft. of average effective depth. The bottoms slope to facilitate sluicing, and wooden covers are provided to conserve the heat. Heavy scrap iron, preferably cast, was formerly used, but recently tinsplate cuttings, as used for precipitating the lead, have been substituted. They are cleaner and give more rapid results. The solution passes through the eight boxes in series, one box being bypassed and washed each day. The sludge is sluiced to a filter, from which the necessary amount is elevated to the silver precipitators. The excess is dried and shipped; the following is a typical analysis of the product:

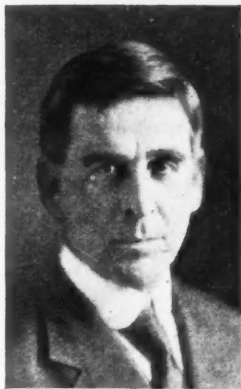
Gold, oz.	0.005	Sulphur, per cent.	0.6
Silver, oz.	134.0	Insoluble, per cent.	3.5
Lead, per cent.	6.0	Iron, per cent.	3.4
Copper, per cent.	63.5		

The Natural History of the Pegmatites*

A Study to Discover Their Mode of Origin and to Explain the Various Phenomena Displayed

By Frank L. Hess

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Frank L. Hess

PEGMATITES, the most striking and bizarre of the rocks, have naturally attracted a great deal of attention from geologists and mineralogists. They have been, and still are, called veins by many, but have been called dikes also by many, and this is now the more common custom. This disagreement indicates a real problem, and it is a problem of many elements.

Probably the outstanding question in the problem involves the origin of the huge crystals, and the great masses of single minerals found in some pegmatites. In no unquestioned vein, in no unquestioned dike, and in no other association have crystals approaching them in size been found. The larger are widely known, but it may be well to mention a few examples.

In the Etta pegmatite at Keystone, S. D., a single crystal of spodumene was 42 ft. by 6 ft. by 3 ft. and many others were nearly as large. Brögger¹ mentions feldspar individuals in a pegmatite at Kure, south of Moss, Norway, that were more than 10 meters (33 ft.) long. The end of a regularly hexagonal crystal of beryl in the No. 1 pegmatite on the Ingersoll claim near Keystone, S. D., is 45 in. from side to side. Quartz crystals from a number of pegmatites have weighed more than 1,000 lb. each, and single masses of tantalite found in one of the pegmatites on the Greenbushes field, West Australia, "weighed about five hundred-weight."² Blake³ described a mass of columbite from the Ingersoll claim near Keystone, S. D., that weighed a ton, but it contained some gangue. Muscovite has been found in the eastern Transvaal in a broad-bladed aggregate 12 ft. by 12 ft. by 8 ft.⁴ A mass of amblygonite in the Peerless pegmatite near Keystone was 27 ft. across, and although other dimensions were not fully exposed, they approached this figure. Microcline and lepidolite are found in masses several times as large, some quartz bodies are much greater, and the Greenland cryolite forms a tremendous mass.⁵

Numerous rare minerals are found only in pegmatites, or in the placers formed from them. Monazite and other rare earth minerals, tantalum and columbium minerals, exploitable bodies of beryllium and lithium minerals, mica, feldspar, and cryolite are found only in pegmatite or very closely related rocks, if in any others.

The erratic distribution of the minerals is another element of the problem. The huge crystals or masses are usually more or less surrounded by mixtures of minerals of finer grain or in smaller aggregates. Minerals along the edges of the pegmatites are usually smaller than those near the middle, and conversely, the largest minerals are usually some distance from the sides of the pegmatites, but large books of mica are commonly within the 4 or 5 ft. next to the sides.

Vugs also are a factor. They are found in the tabular pegmatites such as that on Mount Mica, near Paris, Me., and those near Pala, Calif., but are commoner in the pipes, such as that at Baringer Hill, near Llano, Tex.; those of northern Queensland,⁶ and the New England plateau and the Whipstick district of New South Wales.⁷ Some vugs are large enough to permit a man to stand upright in them, and it is from the vugs that the great quartz crystals and the gem crystals come.

In considering the problem of the pegmatites, one of the most puzzling elements is the seemingly heterogeneous array of minerals, as regards their temperature of deposition. The minerals of the pegmatites are in large part those which we believe to be deposited only at high temperatures, such as beryl, columbite, and the rare earth minerals; yet occasionally molybdenum and other minerals believed to be deposited at moderate temperatures, and galena and other minerals thought to be deposited at rather low temperatures are found. Another element is the introduction of new minerals into the country rock. Around some pegmatites the country rocks are very greatly altered, and large quantities of silica and rarer minerals have been introduced; around others the alteration is not very noticeable.

The introduction of considerable quantities of new matter into the invaded rock involves the removal and replacement of mineral matter already there, but the pegmatites show little evidence of introduction of matter from the country rock, although here and there, as in the tin-bearing pegmatites twelve miles south of Spokane, Wash., the presence of small quantities of andalusite suggests the absorption of alumina from the country rock, but this is very unusual, as the evidence in general shows only an outward movement of material. This is beautifully exemplified in the Idaho case,

*Published by permission of the Director of the United States Geological Survey.

¹Brögger, W., "On the Formation of Pegmatite Veins." Translation from "Die mineralien der syenitpegmatitgänge der sud-norwegischen augit und nephelinsyenit," by Nevil N. Evans. *Can. Rec. Sci.*, vol. 6, p. 67, 1896.

²Maitland, A. Gibb, "Third Report on the Geological Features and Mineral Resources of the Pilbara Goldfield," Western Australia Geol. Surv. Bull. No. 23, p. 67, 1906.

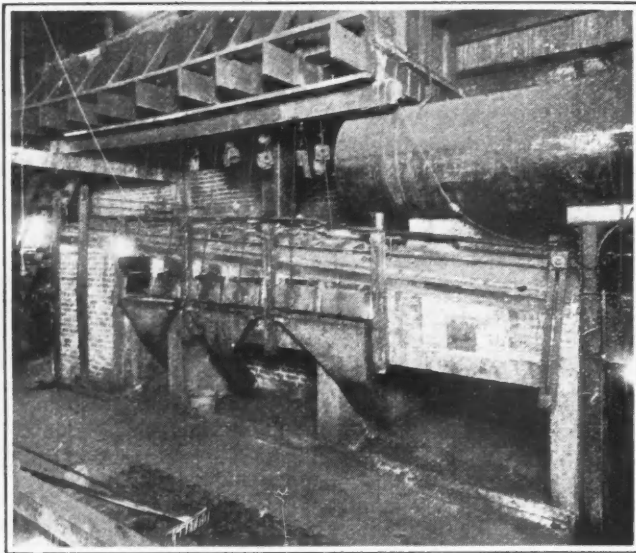
³Blake, W. P., "Columbite in the Black Hills of Dakota," *Amer. Journ. Sci.*, 3rd ser., vol. 38, pp. 340-341, 1884.

⁴Hall, A. L., "Mica in the Eastern Transvaal," Union of South Africa, Department of Mines and Industries, Geol. Surv. Memoir No. 13, p. 21, 1290.

⁵Ball, Sydney, "The Mineral Resources of Greenland," *Maddel- elser om Groenland*, vol. 63, pp. 17-31, 1922.

⁶Ball, Lionel C., *Queensland Government Mining Journal*, vol. 14, pp. 4-6, 1913; vol. 20, pp. 509-511, 1919; vol. 21, pp. 6-11, 50-56, 1920.

⁷Andrews, E. C., "The Geology of the New England Plateau, With Special Reference to the Granites of Northern New England," *N. S. W. Geol. Surv. Recs.*, vol. 8, pp. 239-243, 1909. Also, "The Molybdenum Industry of New South Wales," *N. S. W. Geol. Surv. Mineral Resources No. 24*, pp. 92-117, 1916.



Reverberatory furnace for reducing lead precipitate

The effluent from the "iron boxes," which under ideal conditions is at about 45 deg. C., is now ready for heating to 85 deg. preparatory to precipitation of the lead on detinned scrap. Formerly live steam was introduced directly into the solution, but this had the effect of diluting the solution measurably and throwing the entire plant out of balance. At present heating is done by means of copper coils through which steam from a coal-fired boiler circulates. Condensed steam is caught in a trap and returned to the boiler.

Former practice was to operate these precipitators in series, as is still done with the "iron boxes." The present scheme is to divide the flow equally among eight boxes, and to collect the effluent from these, reheat with more copper coils, and divide the flow for passage through a second set of eight. The feed solution contains 15 lb. of lead, and about 90 per cent of it is precipitated under normal conditions.

The precipitant is scrap tinfoil from which the tin has been removed in a small auxiliary plant. Light scrap instead of heavy is used, because of the necessity for providing a large active surface. The scrap is received and detinned in bales, which affords convenience in handling when the precipitating vats are washed. Two boxes are cleaned out each day, the sludge being sluiced to a settling tank for draining and drying. An incomplete analysis of the precipitate is as follows:

Gold, oz.	0.005	Sulphur, per cent.....	0.5
Silver, oz.	3.40	Insoluble, per cent.....	1.0
Lead, per cent	69.25	Iron, per cent	5.9
Copper, per cent	5.9	Alumina, per cent	4.5

An excessively high alumina content causes additional expense for fluxing and operating the reverberatory smelting furnace used for producing pig lead. Accordingly, it is sometimes more economical to ship the precipitate to the custom smelter. The precipitation of alumina in the lead boxes is less if the acid content is higher.

It is quite essential that operations are closely controlled, or the entire process is likely to be disrupted and recovery spoiled. If the tonnage treated, the sulphur content of the ore, and the temperatures and specific gravities of the various solutions are kept fairly constant, in close proximity to the standard, everything runs well.

If the ore contains more than 4 per cent sulphur, sintering is sure to occur in the roasters. The furnaces do not shake down properly, the fires get bad, the chloridizing is unsatisfactory, and the roasting capacity is greatly reduced. Low tonnage causes the temperature and specific gravity of the circulating solutions to fall, and owing to the low temperature lead chloride tends to precipitate in pumps, launders, and other inconvenient places. When the specific gravities fall, the chlorine content of the leaching solutions diminishes, and as a consequence the extraction of both silver and lead suffers. The change from the direct introduction of live steam to the use of copper coils for heating the solutions entering the lead precipitators was made to obviate these difficulties. Steam is added both in the silver and copper precipitators, though in comparatively small quantity. Experience has shown that the best temperatures are: silver precipitators, 40 deg. C.; copper precipitators, 45 deg. C., and lead precipitators, 85 deg. C. These are approached closely in practice.

The specific gravity of the weak solution—the same as the lead precipitation tails—should be about 1.220; pregnant solution or silver-box heads, 1.230; iron box heads, 1.235; iron box tails, 1.240. The water balance for the whole plant is maintained by the introduction of wash water in the leaching tanks, which offsets the loss by evaporation and the moisture in the tailing.

SILVER RECOVERY IMPROVED

The recovery of silver was increased about 10 per cent, or from 78 to 80 per cent up to 88 or 90 per cent, by returning the copper sulphate from the leaching of the silver precipitate to the weak leaching solution circuit. This maintains the copper content at about 3 lb. per ton in the leaching solution and cupric chloride stimulates the solution of silver.

To the end of improving the recovery of lead, the leaching solutions are saturated with sodium chloride, although this is neither necessary nor desirable for the efficient leaching of silver and copper. Earlier practice was to heat the effluent from the "iron boxes" to only 75 deg. C., the increase to 85 deg. being another measure for increasing the recovery of lead. The cost of treatment, including the refining and marketing of lead, was \$4.49 per ton of ore during 1924. This includes all overhead charges and plant depreciation.

Recoveries for 1924 were as follows: Silver, 87.6 per cent; copper, 59.8 per cent; lead, 32.4 per cent, and gold, 7 per cent. With respect to lead, it should be explained that this figure represents the average for the entire year. Since the new precipitating boxes were installed, during 1924, the recovery has been consistently between 60 and 70 per cent. However, it is not a high-percentage recovery that is aimed at. The problem is to get the maximum net profit out of each ton of ore; or, in other words, to treat the ore so that the difference between the proceeds from whatever products are sold and the cost of operation shall be the maximum.

Construction of the plant was commenced in April, 1920, and operations were started in January, 1921, since which time they have been continuous. H. P. Allen is superintendent in direct charge of operations; and James W. Wade, assistant manager for the Tintic Standard company, has had general supervision of the plant since he assumed his present position early in 1922.



Fig. 3—Microcline (the general mass) replaced by scattered crystals of albite which have traveled out from the vein of albite running through the center of the specimen. Ingersoll No. 3 dike, Keystone, S. D., 1924

erals of large size, which are elsewhere unknown, segregate from comparatively small bodies of magma has been explained as due to liquidity and slow cooling. The patent absurdity of having thin dikes cool slowly and give rise to such enormous, unevenly distributed crystals, although the mother magma, which must have cooled vastly more slowly, gave rise only to a fine, evenly grained mass with evenly distributed minerals, was met by Brögger's lumina,¹² a concentration of water and mineralizers that kept the dike molten at lower temperatures, and by the supposition that the rocks had been preheated by the intrusion of the mother magma. Crosby and Fuller¹³ attempted to explain the problem by supposing that as the outer crystals formed they set free water that made more liquid the remaining magma.

They thought that:

"The pegmatite magma is probably very liquid only in pockets; while for the development of the normal pegmatite a much thicker jelly than the normal granite magma, combined, as in the latter, with extremely slow cooling, dehydration seems to be required. The order of crystallization shows that pegmatite magma is only a more extreme form of the granite magma. In a true igneous or granite magma, however, the size of the crystals is definitely limited by the viscosity; and beyond a certain point it is practically independent of slowness or rate of cooling. It may be noted, also, that while in pegmatite the tabular and prismatic crystals tend to be perpendicular to the walls, in true magmatic consolidation the orientation of the crystals is essentially indifferent to the walls."

¹²Brögger, W., "On the Formation of Pegmatite Veins." Translation from "Die mineralien der syenitpegmatitgänge der sud-norwegischen augit und nephelinsyenit," by Nevil N. Evans, *Can. Rec. Sci.*, vol. 6, p. 67, et al.

¹³Crosby, W. O. and Fuller, M. L., "Origin of Pegmatite," *Amer. Geol.*, vol. 19, p. 177, et al., 1897.

Their statement about the tendency of crystals to form perpendicular to the walls may have little force, as will be shown in the Etta pegmatite.

For the tabular and the more or less cylindrical bodies of pegmatite inclosed wholly within the mother magma, differentiation has been the popular explanation. A common belief has been that this supposed differentiation took place simultaneously with the crystallization of the mother magma.

To explain the irregular segregation and the formation of great crystals and greater masses within the pegmatite, recourse has popularly been had to the all-inclusive term "diffusion."

The nickel-pyrrhotite ores of Sudbury, Ont., have also been referred to segregation, but they lie practically parallel to the contact of the norite, and most pegmatites (including pipes) within the granite are more or less nearly normal to the upper contact. There are notable exceptions, as those at Pala, Calif.

Miller¹⁴ supposes the mother magma to have been highly fluid at the time the pegmatites and quartz masses segregated. The difficulties of thus segregating a solvent, miscible fluid in another fluid seem very great.

Much has been made of comb and concentric structures in the solidified pegmatites. That these exist there is no doubt, and they have been explained by crystallization first along the walls and in successive layers inward. This feature may be overemphasized, however. The concentric structure indicated by the figure of the Etta pegmatite drawn by Gilbert E. Bailey and published by W. P. Blake¹⁵ had apparently been wholly destroyed through mining operations as early as 1908, and it is not noticeable now, though there is a great mass of highly quartzose rock surrounded more or less completely by a feldspar-quartz-mica-spodumene mass, but relations are eccentric.

These hypotheses may be taken as representative, though there are numerous variations. None that I know properly accounts for huge crystals of a specific gravity much greater than that of the magma, which were unattached at the ends and otherwise unsupported in a supposed jelly or liquid and, except for mere cracks that may have formed after total freezing, are

¹⁴Miller, William J., "Pegmatite, Silixite, and Aplite of Northern New York," *Jour. Geol.*, vol. 27, pp. 28-55, 1919.

¹⁵Blake, W. P., "Tin," U. S. Geol. Survey Min. Res. U. S., 1883-84, p. 606.

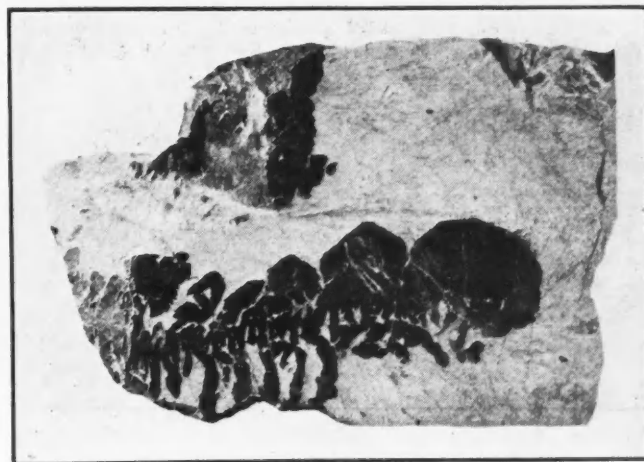


Fig. 4—Albite being replaced by apatite (dark). Ingersoll No. 3 dike, Keystone, S. D., 1924

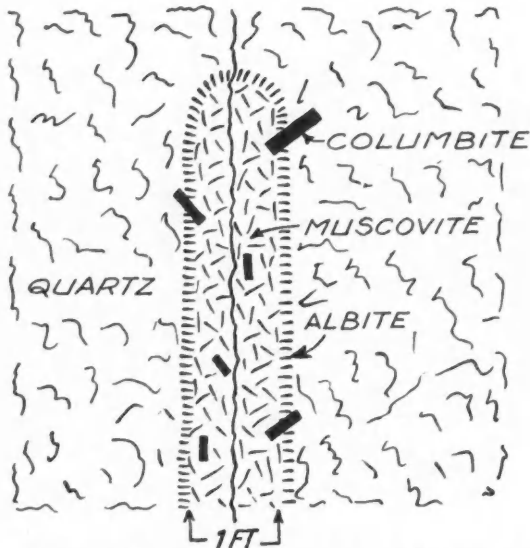


Fig. 1—Field sketch of replacement of quartz by albite, albite by muscovite, and all three by columbite. Peerless claim, Keystone, S. D., 1924

described by President Kemp⁸ last year before the Society of Economic Geologists. There great quantities of schist surrounding a pegmatite are so altered that they look like granite.

Another point for explanation is the very evident relationship of pegmatites to certain quartz masses and quartz veins. Numerous observers have recorded a close connection between the two or the actual merging of one with the other.⁹ Other quartz veins carry some of the minerals of the pegmatites, but no pegmatites are known in the vicinity; thus, a large quartz vein at Tungstonia, 45 miles northeast of Ely, Nev., which was worked for huebnerite, carried also some muscovite and some triplite, typical pegmatite minerals.

Also to be explained is an apparent similarity of the mineralogy of pegmatites and contact metamorphic zones. Sphene, tourmaline, tungsten minerals, mica, garnet, feldspars, pyroxenes, and amphiboles are common to contact metamorphosed limestones and pegmatite.

Relationship to the replacement veins is still closer. In the Deep Creek Mountains on the west side of Utah, there are replacement veins that it is difficult to distinguish from ordinary pegmatites. At one place, 4½ miles south of Goldhill, a pipe is developed that contains masses of microcline, quartz, and actinolite, each several feet in diameter, with large quantities of tourmaline in aggregates of fine black needles. Chalcopyrite, native bismuth (now changed to carbonate), scheelite, molybdenite, apatite, and sphene are also present. The actinolite forms radially disposed crystals as much as 18 in. long, and the molybdenite forms small radial masses. Apatite, bismuthinite, sphene, and scheelite show more or less crystal form. Many of the replacement tin veins have so much in common with pegmatites that it seems probable that in their origin they must also have much in common. As examples of the type

⁸Kemp, J. F., "The Pegmatites," *Economic Geology*, vol. 19, p. 712, 1924.

⁹Hall, A. L., "Mica in the Eastern Transvaal," Union of South Africa, Department of Mines and Industries, Geol. Surv. Memoir 13, p. 20, 1920; Harker, Alfred, "The Natural History of Igneous Rocks," London, pp. 294-295, 1909; Maitland, A. Gibb, "Third Report on the Geological Features of the Pilbara Goldfield," Western Australia Geol. Surv. Bull. 23, pp. 65-69, 1906.

of vein referred to may be mentioned those in the quartz monzonite north of Quimsa Cruz (Tres Cruces) Pass, Bolivia, at the camps of Pacuni, Caracoles, and Huanchaca. These veins are very similar to some of the Cornish veins,¹⁰ and show a succession of replacing minerals, not the same in each vein. The Cornish veins, however, carry some feldspars,¹¹ which were not noted in Bolivia. In some of the Bolivian veins quartz-monzonite is replaced by sericite, sericite is replaced by chlorite, chlorite is replaced by tourmaline, and tourmaline is either replaced by cassiterite or is accompanied by it, by chalcopyrite and by bismuth. In one vein the succession is sericite, quartz, tourmaline-cassiterite. In these veins one mineral has replaced another, the sericite advance guard constantly traveling farther out into the country rock as the invading solutions provided sufficient heat and material.

With these family likenesses among what at first appear to be very diverse deposits, it would seem that an explanation of the formation of one would go far toward explaining the others.

ATTEMPTS AT EXPLANATION

In attempts to explain their origin, all investigators seem to be agreed on one point—namely, that the pegmatites are of igneous origin. From that point onward there is considerable diversity of opinion. However, practically all seem to agree also that in whatever way the pegmatites reached their present places, a great deal of water was concerned, and much is made of other mineralizers—fluorine, chlorine, boron, and sulphur. On these constituents has been placed the responsibility for keeping a magma fluid and mobile and making straight the paths for the movement of molecules, in order that segregation and crystallization might take place readily.

Many have believed that the pegmatites were intruded as wet molten masses into cracks, along planes of schistosity, or along parting planes in gneiss, and that segregation has then taken place.

The difficulty of having crystals and masses of min-

¹⁰Hill, J. B., MacAlister, D. A., and Flett, M. B., "The Geology of Falmouth and Truro, and of the Mining District of Camborne and Redruth," Great Britain Geol. Surv., Memo. Exp. Sheet 352, p. 154 et seq., 1906.

¹¹Dewey, Henry, and others, "Tungsten and Manganese Ores," Great Britain Geol. Survey Mem. Special Reports on the Mineral Resources of Great Britain, vol. 1, p. 20, 1915.

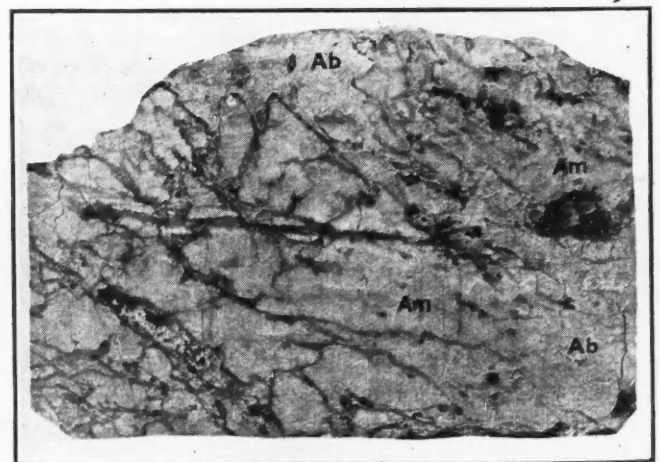


Fig. 2—Amblygonite being replaced along cracks by albite with some muscovite and apatite. Peerless dike, Keystone, S. D., 1924. "Am," amblygonite; "Ab," albite

unbroken by movement of the magma. So far as I know, no suggestion adequately accounts for the excessive quantities of minerals of low solubility such as the columbites, that, under these theories, must have been held in solution, and none satisfactorily explains the presence together of minerals considered as characteristic respectively of high and low temperatures. To these features further reference will be made.

It is important that a number of observers have noted changes in pegmatites after solidification.

Woodward¹⁶ states that some of the pegmatites in the Greenbushes tinfield, Western Australia, "illustrate most clearly metasomatic action, and with a little trouble a complete series of rocks could be collected illustrative of the gradual transition from a pegmatite, composed mostly of albite, through the greisen into a pure quartz specimen, which, when examined microscopically, still exhibits the granite structure, whilst tourmaline and cassiterite are the only associated minerals which have so far been found to exist throughout the entire series."

Hall,¹⁷ speaking of the eastern Transvaal, says:

"As a rule, the pegmatites in which the cassiterite occurs show considerable alteration of the same general meta-

¹⁶Woodward, Harry P., "Notes on the Geology of the Greenbushes Tinfield (With Special Reference to the Deep Leads)," Western Australia Geol. Survey Bull. 32, p. 28, 1908.

¹⁷Hall, A. L., "The Geology of the Waterberg Tinfield," Union of South Africa Geol. Surv. Trans. 4, p. 101, 1909.



Fig. 5—Tongues of quartz, albite, and lepidolite replacing microcline, which has already been partly replaced by albite. Camp Harding, 11 miles east of Embudo, N. M., 1924

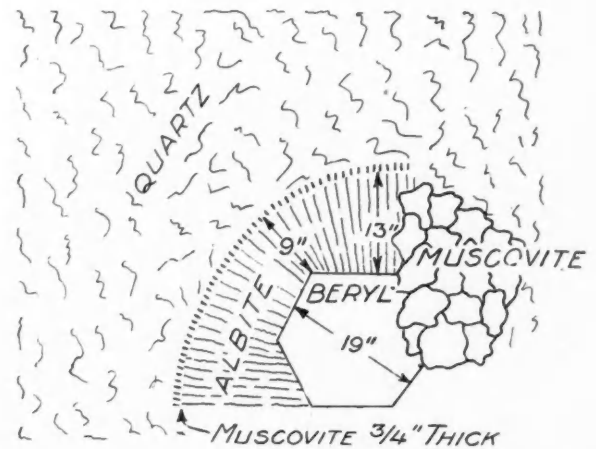


Fig. 6—Field sketch of muscovite replacing quartz, with successive replacement by albite and beryl. Peerless dike, Keystone, S. D., 1924

somatic character as that found in connection with the deposits in the granite. Biotite, when present, has been altered to chlorite, and both sericitization and tourmalinization also occur, together with fluorite. Arsenical pyrite, molybdenite, wolframite, orthite, and carbonates are also sometimes present, and brecciation is an exceedingly common feature. The cassiterite itself, as already pointed out, sometimes replaces the original quartz.

"Under these conditions it is difficult to regard the cassiterite and its associated minerals as original constituents of the pegmatites, and one must conclude that . . . they are of slightly later introduction. . . . The evidence appears to indicate that the pneumatolytic compounds attacked the quartz, feldspar, and biotite of the pegmatites after their solidification."

Brögger¹⁸ considers that bismuthinite, bismuth, gold, molybdenite, sphalerite, pyrrhotite, chalcopyrite, boronite, fluorite, and parisite belong to the "pneumatolytic phase," by which it is thought he means that these minerals were brought in by gaseous emanations after the pegmatite has solidified and they must therefore have replaced some other mineral.

Sterrett¹⁹ came close to the solution when he wrote with his characteristic incisiveness:

"It is difficult to decide whether some deposits of pegmatite were formed as dikes or as veins, but the conditions in others clearly point to the one or to the other mode of origin. There seems to be no objection to assuming an intrusive origin for most pegmatites which have a typical granitic texture and in which none of the constituent minerals are separated out into sheetlike masses parallel to the walls, especially those that are more persistent in extent in regions where granite intrusions are large or plentiful. On the other hand, deposits that are banded with veinlike sheets of quartz parallel with the walls, and smaller irregular masses, streaks, lenses, augen, or balls that have no visible connection with other bodies of pegmatite, were probably formed from solutions. Some pegmatites were possibly formed in part by the intrusion of a magma and later modified by the passage of solutions from the same source."

Larsen and Schaller²⁰ have, during their past season's work, at Pala, Calif., come to much the same conclusions as those about to be set forth in this paper, and have followed out some of the processes in detail.

The pegmatites near Keystone, S. D., present such an array of unusual minerals in individuals and groups of such gigantic size that they have naturally attracted

¹⁸Brögger, W. C., "Die mineralien der südnorwegischen granitpegmatitgänge." Videnskabs-Selskabets Skrifter, pp. 26-27, 1906.

¹⁹Sterrett, Douglas B., "Mica Deposits of the United States," U. S. Geol. Surv. Bull. 740, p. 10, 1923.

²⁰Schaller, Waldemar T., Papers delivered before the Pick and Hammer Society and before the Nat. Acad. of Sci., as yet unpublished.

much attention from geologists and prospectors, and they offer unusual opportunities for study. Probably the best known and also those showing the greatest diversity of minerals are the Peerless, Etta, and Ingersoll pegmatites.

The Peerless pegmatite forms the crest of a hill, which rises south of Keystone. In plan it is somewhat tear-shaped, with the tail extending northwest and a hump on the west shoulder. The body of the mass is possibly 150 ft. across and 250 ft. long. The tail is 30 ft. wide and pinches out in about 100 ft. The body stood possibly 30 ft. above the top of the hill, and this 30 ft. was mostly a great mass of quartz.

The workings in the pegmatite include a T-shaped cut about 35 ft. deep, with a stem about 75 ft. long and 25 ft. wide running northeasterly and the cross-bar 100 ft. long and 35 ft. wide. The bottom of the cut is in a mixture of microcline, quartz, etc. The great mass of quartz lies a few feet above the floor and has a rather irregular base.

Near the northwest end of the cross-bar a vertical crack cuts the quartz (Fig. 1) and a mass of muscovite in plates 1 in. or less across, with less albite, cassiterite, and columbite, follows the crack, 4 to 5 in. wide on each side, coming to a rounded end above, the crack continuing on in the quartz. Along much of the edge of the mica-albite, a bristling border of albite crystals juts into the quartz. Columbite crystals extend beyond the albite into the quartz, and irregular small masses of columbite and cassiterite occur between the mica books.



Fig. 7—Quartz partly replaced along cracks by albite, muscovite, and apatite. Peerless dike, Keystone, S. D., 1924, Q, quartz; Ab, Albite



Fig. 8—Fragment of quartz, showing how it has been eaten into and the impressions left by plates of albite. Peerless dike, Keystone, S. D., 1924

A single well-formed crystal of columbite at the edge of the mica, but largely imbedded in the quartz, weighed more than 200 lb.

It is evident that here the quartz has been replaced by minerals deposited by a solution following the crack; that the albite replaced the quartz, the muscovite replaced the albite, and the columbite replaced all three. Cassiterite has replaced the muscovite, and probably the albite. The same replacement of the muscovite was seen in both the Etta and the Ingersoll pegmatites.

The replacement of other minerals by albite is a common phenomenon in the pegmatites. On the Peerless claim, albite has replaced amblygonite (Fig. 2) along cracks in such a way as to leave no doubt of the event. Original marking and cleavage in the amblygonite can be followed from one piece to another, though the albite between is unaffected.

A specimen of microcline from the No. 3 pegmatite on the Ingersoll group of claims (Fig. 3) is cut by a narrow veinlet of albite, and scattered through the microcline are groups of crystals that have evidently traveled out from this or other veinlets or cracks. In the same dike albite is replaced by apatite (Fig. 4).

At Camp Harding, between Rinconada and Peñasco, N. M., in a cut made by the road through a pegmatite, long tongues of quartz, lepidolite, albite, and orthoclase reach upward into a mass of microcline (Fig. 5). A section of the replaced rock looks as if the albite and mica were actually marching upward to attack the microcline. But albite had soaked well into the microcline ahead of the visible replacement.

In pegmatites albite is a universal devourer, although it is itself eaten by others. However, its crystals are not everywhere the advance troop of the marauding

minerals. Close to the southwest edge of the Peerless pegmatite, in the same quartz mass in which the replacement already described took place, positions of the muscovite and albite were reversed (Fig. 6). Here, the end of a white beryl crystal 19 in. across between faces is exposed. Around it is an aureole of albite from 9 to 13 in. across, and, normal to the edge of the albite aureole, leaves of muscovite $\frac{1}{4}$ in. broad extend into the quartz mass. Here, the succession is quartz replaced by muscovite, muscovite by albite, and albite by beryl.

In other places in the Peerless pegmatite, the quartz is greatly cracked on its under side. Into these cracks have been carried mixtures of albite, apatite, and muscovite, and they had begun to replace the quartz when the processes were brought to a close (Fig. 7). That the replacement was real is shown by weathered



Fig. 9—Microcline (light gray) partly replaced by mica, which shows as specks through the microcline. Fine-grained mica fills up the space between the fragments. Peerless dike, Keystone, S. D., 1924

pieces (Fig. 8), in which corrosion is plain, and the cavities eaten out to make room for thin mica books or albite crystals are apparent.

The same replacement was seen in a pegmatite on Tin Mountain 8 miles west of Custer, S. D.; in the Fridlund pegmatite, 2½ miles southwest of Petaca, N. M.; in a pegmatite in the Wichita Mountains, Oklahoma; in the Frost quarry, $\frac{1}{2}$ mile south of Davis, Md.; and in specimens from Amelia Court House, Va., and will undoubtedly be found in many others.

Muscovite also replaces other minerals when unaccompanied by albite. Brecciated microcline on the southwest side of the Peerless pegmatite is visibly impregnated by muscovite. Spaces between the fragments of the microcline are entirely filled with fine grained mica (Fig. 9). In places strueverite, a complex titanium, tantalum, and columbium mineral with the form of rutile, has come in with the muscovite. Similar replacements without the strueverite are found in the Ingersoll pegmatite No. 3. The mica is locally

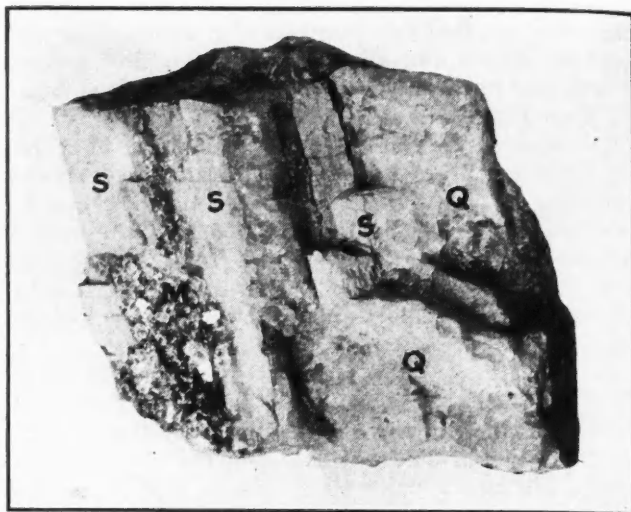


Fig. 10—Crystals of spodumene in quartz being replaced by pink muscovite. Camp Harding, 11 miles east of Embudo, N. M., 1924. "S," spodumene; "M," muscovite; "Q," quartz

called lepidolite, but the specimens collected give no reaction for lithium.

In all the pegmatites examined, though this is not given as a general rule, muscovite in large books was within the 4 or 5 ft. next to the side of the dike. It will be seen that in dikes 10 or 12 ft. thick or less this would allow the statement often made that "the mica books are all through the dike" to hold good. The large books are replacements of the earlier minerals.

In the Camp Harding, N. M., dike, a beautiful pink muscovite replaces spodumene (Fig. 10) and practically all other minerals. Great masses of microcline are given a pink color by the invasion of the pink mica. In the face of the Moody quarry, $\frac{1}{2}$ mile south of Davis, Md., biotite clearly follows and spreads out from cracks in a microcline-albite-quartz mixture.

In the open-cut workings on the Ingersoll No. 3 pegmatite, lepidolite forms along a crack a somewhat tabular mass 6 ft. thick and 15 or 20 ft. long, which has eaten its way into amblygonite, microcline and

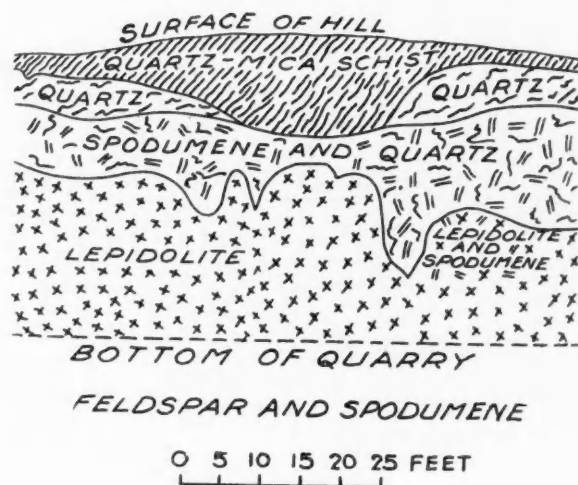


Fig. 11—Field sketch showing distribution of quartz, spodumene in quartz, and lepidolite. Camp Harding, 11 miles east of Embudo, N. M., 1924

quartz. At greater depth the mass becomes larger and relationships are obscure.

The replacement of microcline by albite and lepidolite at Camp Harding, N. M., has already been mentioned. The great body of lepidolite seems to have replaced massive quartz, spodumene, and all other minerals in its way (Fig. 11).

On the deposition of microcline (and most of the feldspar in pegmatites that has been described as orthoclase is probably microcline), the evidence is not yet as complete as is desirable. In the Peerless pegmatite, edges of two microcline masses exposed at the base of the quartz are straight and about 8 ft. long. They suggest crystals formed either by replacement or in a vug, but as there are no other signs of a vug, they are quite surely replacements of the quartz.

At Camp Harding, it seems probable that microcline has replaced quartz containing spodumene, and the spodumene is reduced to rounded masses. Of the numerous pegmatites in which I have seen spodumene, this alone contains rounded individuals. Both microcline and spodumene are colored pink by muscovite (Fig. 12).

In the Etta pegmatite, long famous for the great size of its spodumene crystals, spodumene is found from the circumference to the center, but the crystals are much smaller at the periphery than in the middle. They are imbedded in the great quartz masses (Fig. 13) and also in a mixture of quartz, microcline, mica, and other minerals. A striking peculiarity of the arrangement of the minerals is the radial disposition of crystals from 3 to 6 ft. long, and another peculiar fact is that the centers of the masses are fine-grained pegmatite. Radial disposition in three dimensions, with crystal terminations of the minerals at the outer ends, may, I believe, be accepted as a sign of replacement. Crystals formed in vugs have their terminations pointing toward a center, but if radial crystals are to form at all, they must be supported in every

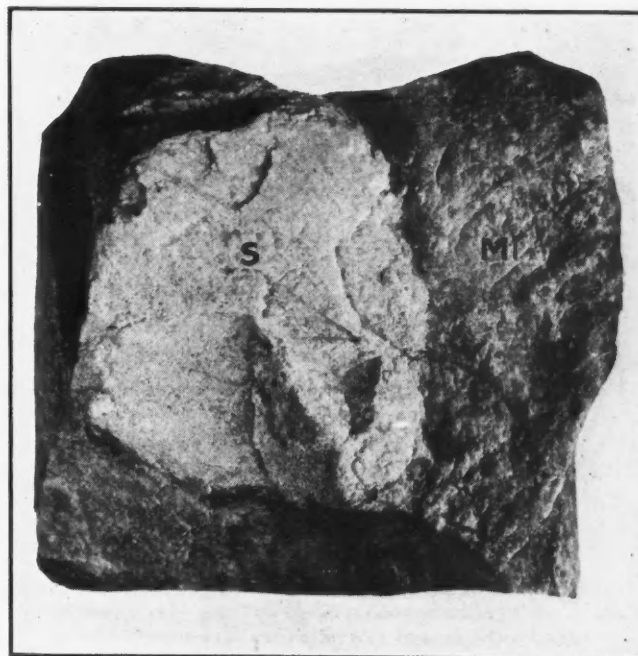


Fig. 12—Rounded part crystal of spodumene in microcline. Both are colored pink by muscovite. Camp Harding, 11 miles east of Embudo, N. M., 1924

direction. Pyrite balls formed in sediments illustrate the point. The large spodumene crystals in the quartz are probably likewise a replacement.

At Camp Harding, crystals of spodumene, all pointing upward probably within 45 deg. of the vertical, occur in the quartz that forms the upper part of the pegmatite, but only in places do they reach the roof; in other places there is 5 to 7 ft. of barren quartz above them (Fig. 11).

As has been said, a mass of columbite weighing about a ton was at one time extracted from the Inger-

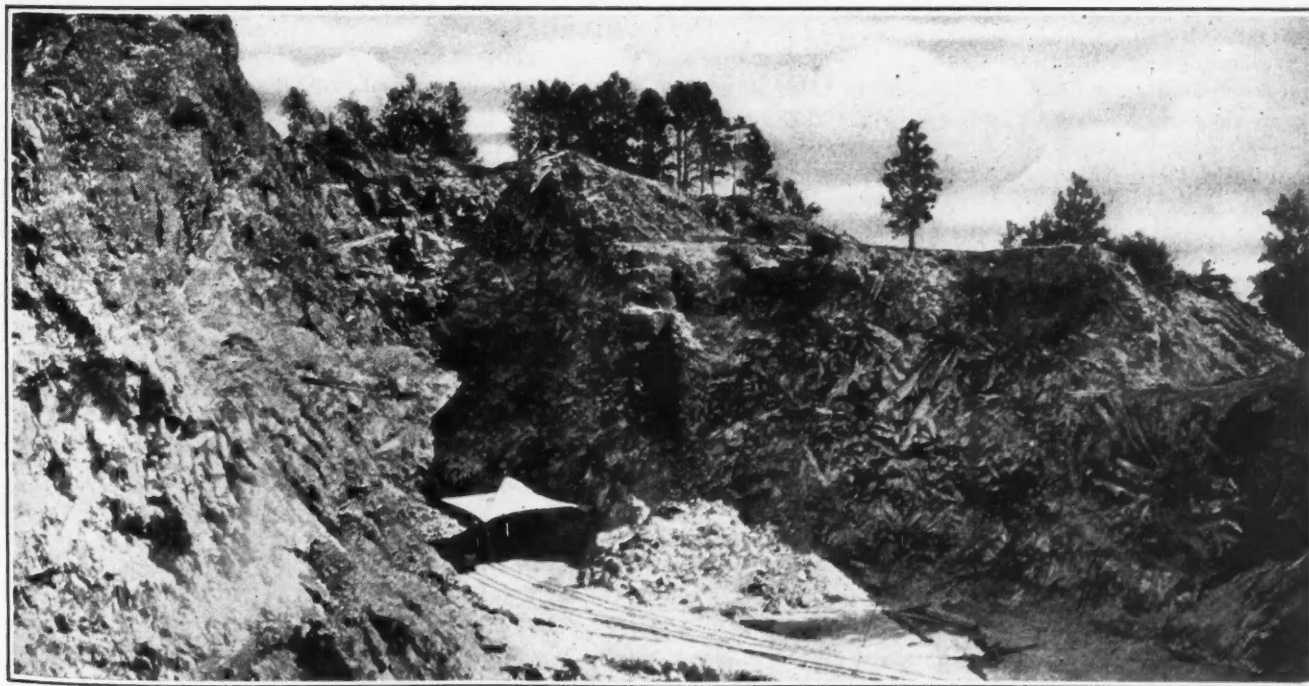


Fig. 13—View of part of opening in Etta mine, showing radial crystals of spodumene. Keystone, S. D., 1924

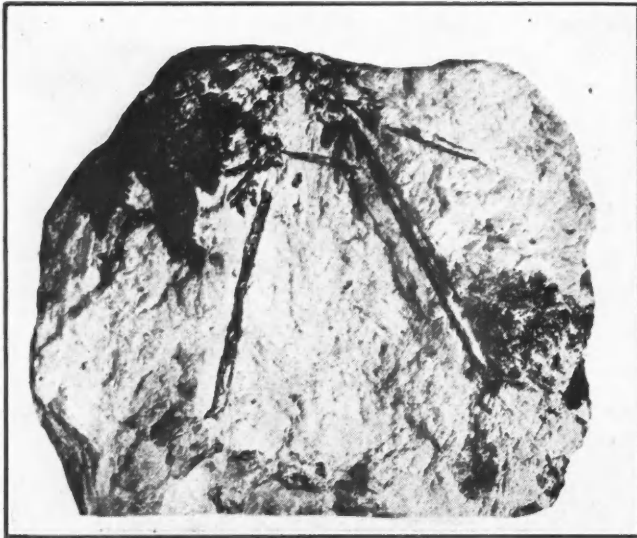


Fig. 14—Radial plates of columbite accompanied by cassiterite (black mass at lower right), replacing albite. Ingersoll No. 3 dike, Keystone, 1924

soll No. 3 pegmatite. The mass was made up of radial plates of columbite with a small quantity of quartz between them. Radial crystals of columbite (Fig. 14) are also found in other parts of the pegmatite and reach more than a foot in length, something less than a foot in width, and may be less than $\frac{1}{8}$ in. thick. They have evidently eaten through the earlier minerals.

At Petaca, N. M., the Fridlund pegmatite contains a good many small masses of a radioactive rare earth mineral not yet analyzed that has the index of refraction of eschynite (a columbate and titanate of the rare earths). It is found in both quartz and microcline, but by far the most of it is in microcline. One specimen shows radial crystal form (Fig. 15) and another shows a narrow quartz vein cutting microcline (Fig. 16). The quartz gives way to the eschynite (?) and leads to an enlargement. There can be little doubt that it, too, is a replacement.

Wolframite, cassiterite, arsenopyrite, bismuthinite, and molybdenite are apparently all late comers; in many places they show crystal form and are connected with distinct quartz veins. However, cassiterite seems to come with the hottest of the solutions and the others are probably deposited in a cooling mass.

Galena and sphalerite probably are deposited with very late solutions that are comparatively cool.

As has been noted by many observers, the large one-mineral masses, excepting those of quartz, occur in the central part of the pegmatites and away from the walls. Spots of very much finer-grained material are occasionally found along the walls of the coarse pegmatites, but such spots are also found within the main body of the pegmatite.

In the Peerless pegmatite, small masses of comparatively fine-grained pegmatite similar in texture to some of the small dikes of the region are found at several places along the walls (Fig. 17). Similar fine-grained masses are present along the walls of the Etta pegmatite, and also in the centers from which radiate spodumene crystals. Ball mentions fine-grained masses of pegmatite around the periphery of the great Ivigtut cryolite pegmatite.²¹

²¹Ball, Sydney H., "The Mineral Resources of Greenland," Med. om Groenland, vol. 63, p. 18, 1922.

In some places the minerals of the pegmatites are carried into the country rock. At both the Ingersoll and Peerless mines, part of the schist is replaced by tourmaline, or by tourmaline and quartz. In two known places at Camp Harding, the quartz-mica schist has been so largely replaced by lepidolite that it has been shipped for its lithium content. Silicification of the country rock is common, and, in places around the Etta mine, only by traces of the original bedding is one able to tell whether the rock is pegmatite or replaced schist.

PHENOMENA EXPLAINED ONLY BY LONG-CONTINUED FLOW OF SOLUTION

The enormous amount of replacement that has taken place around some pegmatites, as noted by Kemp (quoted earlier in this article) and others, the common replacement of minerals after being once deposited in pegmatites, the huge crystals, and the great masses of single minerals can, I think, be explained satisfactorily in only one way—by the long-continued flow of solution.

If we imagine that a wet molten mass—that is, a magma containing much water—were intruded either into schists that fold around the dikes or into cracks the shape of which the dikes must take, the sides of the dikes are more or less chilled. The middle remains hot and molten longer, but finally solidifies. The dikes we all believe to be one of the phenomena of expiring igneous intrusion. Accompanying and following the intrusion of the dike is a great quantity of fluid that is squeezed out and flows continuously from the parent magma as it freezes. This fluid was a part of the molten magma and may be conceived to have held it in solution. It not only carries all the common elements that froze in the magma, but carries others soluble in such a fluid at temperatures below that at which the magma froze. The path followed by the pegmatite is, apparently even after the freezing of the pegmatite, often also the path of least resistance for the fluid, and it flows through the middle or hottest part of the pegmatite, dissolves minerals soluble at the temperature of the fluid, and carries them to a cooler place for redeposition and at the same time deposits, according to

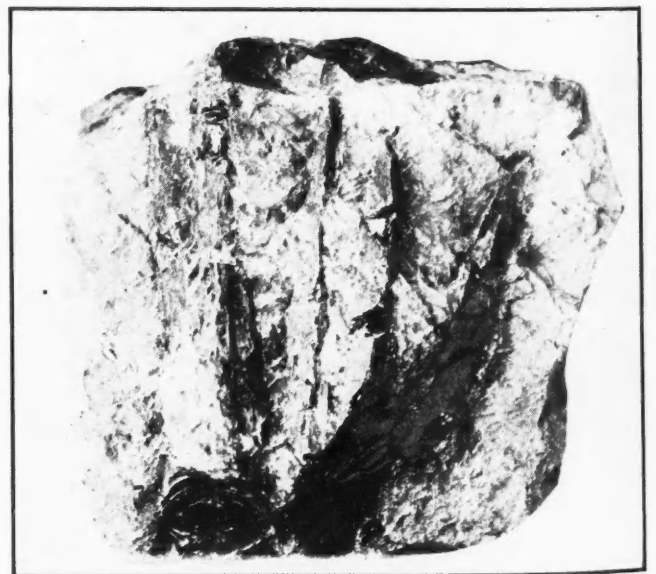


Fig. 15—Radial crystals of eschynite (?) replacing microcline, Petaca, N. M., 1924

temperature and perhaps other conditions, the minerals it already held in solution. Apparently, quartz is one of the minerals that is held in solution longest—that is, at the lowest temperature—and so is carried farthest, forming the quartz veins and quartz masses that have frequently been noted in connection with pegmatites, and it probably also replaces the minerals of the pegmatite in its coolest—that is, its uppermost—parts. But quartz may be deposited at any temperature found in the pegmatite, and so may be of many generations.

As the somewhat cooled dike heats up through the



Fig. 16—Thin quartz vein, cutting microcline and giving way to eschynite, which spreads out and replaces the microcline. Petaca, N. M., 1924

continued flow of the magmatic solutions, quartz and others of the original fine-grained minerals are attacked, and minerals, such as beryl, columbite, and cassiterite, carried by the solutions, take their place. Minerals first deposited by the invading fluid may be redissolved and moved to a higher or cooler place. Nuclei of microcline, amblygonite, spodumene, muscovite, etc., grow to great size as the passing liquid drops its load from the cooling magma and carries another forward.

On account of excessive cooling at the time of intrusion or because they are remote from the channels allowing the freest movement of solutions, some parts of the original pegmatite may be left, as has been noted. Where the movement continues long enough, the entire dike may be entirely reworked into new minerals or into a new distribution of them so that no fine-grained masses are left. Somewhat similar events seem to have taken place in the deposition of many ore veins, and the relation between ore veins and pegmatites seems closer than has generally been thought.

Probably, in many dikes, solution takes place at some points faster than deposition, and vugs are formed, in which tourmaline, spodumene, quartz, beryl, and other minerals form especially clear crystals, because there is no interference from the debris of

minerals being removed to make room for the new-comer and none of the incipient cracking that frequently takes place in the mass. The same process takes place during the formation of some ore veins. Many such solution cavities have been found in the Cripple Creek district, Colorado, a region of narrow veins. At the Cresson mine, a cavity was found the greatest dimensions of which were 23 ft. x 13½ ft. x 40 ft.²³ Although partly formed by spalling of the walls, the cave was mostly caused by solution of the volcanic rocks. The walls were covered with vein minerals.

There comes a time when the fluid becomes less plentiful, and, cooling, works downward from the surface, and minerals of the lower temperatures, never very common in pegmatites, collect in small masses. They include calcite, galena, chalcocite, molybdenite, pyrite, etc.

We do not need to balk or stumble at the movement of fluids through rock. We have long accepted the idea in principle by believing in sericitization, chloritization, contact metamorphism, and metasomatism in general, and the examples given have shown evidence of the movement of solutions carrying quartz, micas, albite, etc., through other minerals. How fast the fluids move we do not know. Geologic time is long, and the process may be unimaginably slow. The fluids may travel along cracks that had no dike forced into them, and here they deposit real pegmatite veins. All the minerals of the other pegmatites may be deposited, fine grained, next to the wall, where cooler, with more or less replacement of the wall rock. The coarse minerals naturally are deposited in the hotter middle part of the vein.

The fluids may travel through other cracks, too narrow for accumulations between the walls, and so the walls may be replaced. In such replacement-veins nearly all the phenomena of the pegmatite dikes are repeated, starting with the granitic rock as a basis for attack instead of a fine-grained pegmatite. At the junc-

²³Patton, H. B. and Wolf, H. J., "Preliminary Report on the Cresson Gold Strike at Cripple Creek, Colo.," *Colorado School Mines Quart.*, vol. 9, p. 10, 1915.



Fig. 17—Remnant of fine-grained pegmatite at edge of Peerless dike, Keystone, S. D., 1924

tions of cracks, removal of the original rock may take place very rapidly either with or without replacement, forming pipes or vugs.

The tin veins mentioned earlier in this paper, and the close relationship to pegmatites of the tin veins of Cornwall with their microcline, tourmaline, cassiterite, and wolframite,²² are easily explained on such a hypothesis of origin.

Contact metamorphic deposits are parallel in their formation to the replacement vein deposits, the cracks along which the fluids travel being in limestone or some other replaceable rock, instead of the original igneous rock.

The assumption of the passage of great quantities of fluids through the masses of rocks also makes understandable the origin of coarsely porphyritic and orbicular rocks, for individual crystals or orbicules probably grow at the expense of their neighbors' space, and in part possibly at the expense of their substance, as they feed from passing solutions and the solutions simultaneously dissolve and carry away the neighbors. Whether these fluid solutions are liquid or gas is not known, but I find it hard to conceive them as other than gas.

Dredging for Platinum in Colombia

MOST of the platinum from the Chocó region, in Colombia, is won from gravel in the present river beds and flats adjoining them, and it is a noticeable fact that, where payable deposits are found, these rivers pass through or have their source in an area of what is termed locally "caliche," according to *The Mining Journal* (London) in a sketch of the operations of the British Platinum & Gold Corporation, Ltd. This caliche, in its turn, was derived from the erosion and decomposition of basic volcanic rocks, and may have been laid down in a lake or a wide river, or it may have been brought to its present position by glacial action.

Thus it will be seen that the platinum deposits now being worked are the result of two concentrations by nature—namely, first from the country rock to the caliche, and second, from the caliche to the present river gravels.

Owing to the necessity for platinum during the war and also owing to its scarcity, largely due to the cessation of platinum mining in the Ural Mountains during that period, the British Platinum & Gold Corporation, Ltd., came into being to work platinum mines and properties in the Chocó district, and two modern dredgers have been installed for that purpose. These dredgers, built by Lobnitz & Co., Ltd., of Renfrew, to the design of Inder, Henderson & Dixon, consulting engineers to the corporation, are of open-connected bucket type. The value of this type has been proved, as in some places a considerable amount of fallen timber has been encountered in the gravel. The buckets discharge the gravel on shaking screens, with which the dredgers are provided in place of the usual revolving type of screen. By using a shaking screen, not only is a larger screening area available, but the necessity of using an elevator to stack the coarse tailings is eliminated, except in occasional cases. No. 1 dredger has no elevator, but as No. 2 dredger is working some

ground of exceptional nature with a high bank in front of her, an elevator is being provided.

HOW THE GRAVEL IS HANDLED

On reaching the screens, the gravel is treated with a liberal supply of water, which, together with the longitudinal motion of the screen, thoroughly disintegrates it and any clay that may be present. The upper end of the screen is provided with perforated plates having holes $\frac{1}{2}$ in. in diameter, followed by plates having $\frac{3}{8}$ -in. holes, which, in turn, are followed by plain plates to the after or discharge end of the screen. By placing the plates in the above order the $\frac{3}{8}$ -in. holes do not choke. When holes of these sizes are used, there is a large factor of safety, as less than 2 per cent by weight of the platinum is retained on a 20-mesh sieve. The portion that will not pass through these screens is rejected as coarse tailings. The material that passes through the screen plates next flows through two sluices, the same width as the screen and lined with riffles, and then over the gold tables, which are covered with coconut matting and expanded metal. More than 80 per cent of the platinum is caught on the upper sluice, and but little on the gold tables. From the latter, the gravel and sand pass over the stern of the dredger as fine tailings.

Once a week these sluices and tables are cleaned up, and the material therefrom is streamed down in a small sluice lined with miners' plush and green baize, from which a product containing one part of platinum to approximately three or four parts of black sand is obtained. The platinum is separated from the black sand in an interesting manner, a method, practiced by the natives, of floating off the sand, being used.

The crude metals recovered from the dredgers contain about 75 per cent of platiniferous metals and about 25 per cent of gold, which is removed by amalgamation, an operation that must be carried out using as little mercury as possible. The amalgam must be "dry," for if it becomes pasty, grains of platinum are incorporated with it and a clean separation of the gold and platinum cannot be effected. The actual separation of the amalgam and the platinum is performed under water on a sieve having 20 meshes to the inch, and the grains of platinum pass through the sieve. A fairly clean separation can be made by such mechanical means, as will be seen by the analysis that follows; the platinum contains about 0.3 per cent of gold, and the retorted gold about 1 per cent of platinum. The crude platinum is then ready for shipping to England for refining by chemical means. A typical analysis is as follows:

Gold, 0.31 per cent; palladium, 0.54; platinum, 86.50; iridium, 1.15; rhodium, 0.63; osmiridium, 0.39; base metals, 9.89; and sand, 0.59. The base metal consists chiefly of iron, with occasional traces of copper.

The production of platinum and gold by the corporation began in December, 1920, and in the following table statistics are given of various items for the financial years ended July 31 of each year. During the year ended July 31, 1924, two dredgers were in operation, but as No. 2 did not commence work until May, 1924, the production was mainly from No. 1 dredger:

	1921	1922	1923	1924
Platinum won, oz.	1,576	1,885	4,074	5,090
Gold won, oz.	446	660	1,077	1,540
Average value per cubic yard	36 42	25 94	60 82	60 43
Number of cubic yards dredged	177,000	314,700	329,830	508,089
Platinum, grains per cubic yard	4 27	2 87	5 94	4 81
Gold, grains per cubic yard	1 21	1 01	1 52	1 45
Tribute platinum, oz.	273	244	255	276

²²Dewey, Henry, and others, "Tungsten and Manganese Ores," Great Britain Geological Survey Mem. Special Reports on the Mineral Resources of Great Britain, vol. 1, p. 20, 1915.

A Proposed Method for Caving Oil Shale

Estimated Costs of Mining Certain Strata in the De Beque-Grand Valley District in Colorado

By Fred Carroll and G. R. De Beque

Mining Engineers, Denver, Colo.

OF ALL THE METHODS that have been proposed for mining oil shale in the De Beque-Grand Valley district, in Colorado, none, in our opinion, is suited to the particular conditions found there. It is believed that in the early stages of large-scale production only the shales containing the largest potential oil content will be mined. To do this and conserve for future use the leaner overlying shales is the outstanding problem.

The accompanying photograph shows a typical occurrence of shale in the De Beque-Grand Valley district. It will be noted that the high-grade seam B, 50 ft. thick, lies between two other seams A and C, both of which are of lower grade. The accompanying sketch is intended to show a method of development preparatory to undercutting and caving the high-grade seam B.

It is proposed that development work, consisting of haulage ways, auxiliary drifts, chute raises, and caving pockets, would be confined to seam A and that the tops of the caving pockets would extend upward to the lower side of the high-grade seam B. Large parallel haulage ways would be driven at intervals of approximately 64-ft. centers at the bottom of seam A. Auxiliary drifts would be used as gangways from which cross-drifts would be driven to the tops of the chute raises, where the bulldozing would be done. Caving of the high-grade seam B would be started by drilling and blasting out the tops of the 6-ft. pillars surrounding the caving pockets.

LEANER STRATA MAY BE MINED LATER

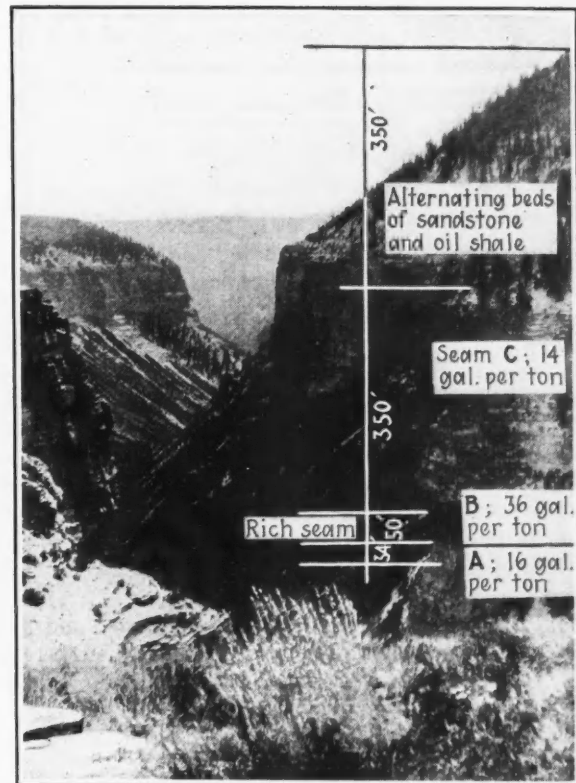
The chute raises would be used as measuring pockets to hold about six tons each or one-half of a mine carload. The chutes would be staggered and would necessarily operate from both sides of the haulage way and a mine car would take the contents of two chutes at one spotting.

This method, in our opinion, will meet every requirement. The high-grade seam B can be removed through caving and the overlying 350 ft. of leaner shale C allowed to settle and be conserved for removal, in the same manner, at some future time. Natural ventilation can be employed to advantage, and if found necessary mechanical means may be used to force the circulation of air. The shale dips at low and uniform angles. Advantage can be taken of this condition for favorable natural grades for haulage and drainage.

If, for any reason, the shale should not cave readily, or if large pieces should come down into the pockets, it would seem that it would be feasible to work from the bulldozing chambers and blast, or drill and blast, until the material starts running. Should it be found more advantageous to adopt stoping methods for breaking a portion of the shale, they can be applied in combination with the arrangement suggested herein.

Although so little shale mining has been done in this country that the important factors of cost are unknown, we have been able to gather data that permit estimates to be made.

An improvised electric-driven auger drill did efficient work at the Mount Logan mine, near De Beque, Colo. Four-foot holes were driven in seven minutes. W. L. Sheeler, of the Catlin Shale Products Co., at Elko, Nev., states that he is "mining with electric auger drills without drill columns. Two men drill forty 6-ft. holes



Typical oil-shale deposit in De Beque-Grand Valley district showing the variation in oil value of strata

per 8-hr. shift. Seven holes are drilled in headings." Holes in excess of 4 ft. were not attempted at Mount Logan, on account of the limited length of auger drills; but the ease with which the holes were made, the demonstrated use of auger drills at Elko on shale, and the general use of augers in coal mining, it is believed, indicate that with machines of improved design holes up to 18 or 20 ft. can be made. An almost perfect shaving is produced and there is little or no dusting. The grade and quantity of explosives required have not been accurately determined, but from such information as has been secured we make maximum estimate at 1 lb. of 40 per cent gelatin per ton of shale broken.

From the foregoing, we feel warranted in estimating the maximum cost of drilling at 4c. per linear foot, or ½c. per cubic foot, and explosives at 1c. per cubic foot of shale broken in development as herein proposed. It is believed that all charges, including labor, explosives, and power, will amount to 4c. per cubic foot of

Milling Details at New York and Honduras Rosario

From the annual report of the New York & Honduras Rosario Mining Co., the only important producer of silver and gold in Central America, the following details of mill operation are obtained.

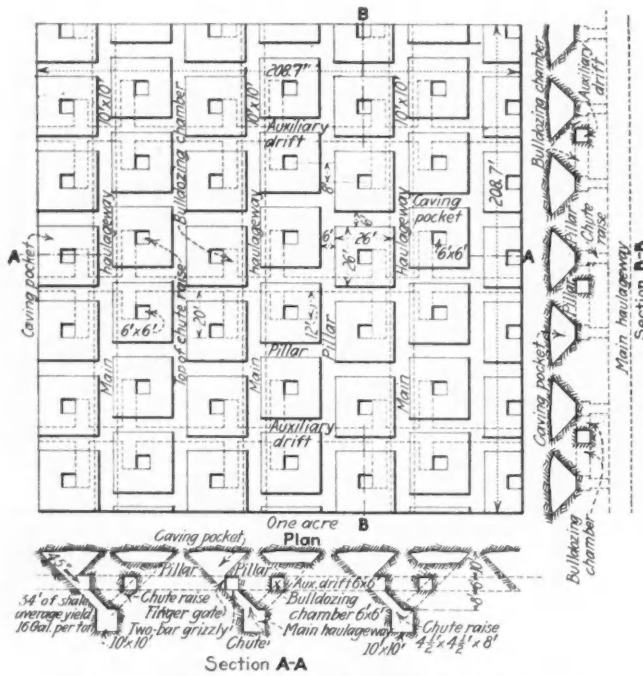


Diagram shows proposed method of mining oil shale in Colorado

Haulage ways, auxiliary drifts, chute raises, and caving pockets are to be in the leaner seam, the actual mining to be confined to the 50-ft. stratum of 36-gal. rock.

shale broken. At this rate the cost per acre for these items would be \$9,600. Air lines, tracks, timbers, finger gates, and other material and labor for installing, we estimate to cost \$11,400 per acre. To these combined amounts we have added 30 per cent to cover overhead operating charges, making a total direct cost of \$27,300 for development of one acre as shown in the illustration.

Seam B contains 108,000 long tons per acre and there would be extracted in the course of development from seam A 12,000 tons, making 120,000 tons of 34-gal. shale over which to spread the cost of development, equivalent to 22.75c. per ton of shale, or 28.10c. per barrel of oil yielded.

TOTAL MINING COST ESTIMATED AT 60c. PER BARREL OF OIL

The caving and tramming cost should not exceed that of the porphyry coppers or Alaska-Juneau. Roughly, a cost of 25c. per ton, equivalent to 31c. per barrel, of oil-yield from seam B may be expected. Thus the total mining cost for shale from this seam delivered at surface should not be more than 60c. per barrel of oil yielded.

Attempts have been made to classify the shale beds according to quality and to consider as workable only those more than 5 ft. in thickness that show a yield of 15 gal. or more per ton. There are about twenty-one such beds as shown by assay logs which may be accepted as accurate. Eleven of these are interstratified in seam C; three are included in seam B; one is in seam A, and the remaining five lie below seam A at vertical distances of from 50 to several hundred feet. Only one of such beds lying above seam B yields as much as 25 gal. of oil per ton. In view of this condition, and in consideration of the fact that the average of the entire 350 ft. is almost 14 gal., the expected advantages of the caving plan for mining as suggested herein are obvious.

Tonnage Crushed		1924	1923
Total wet tons received	84,078	98,862	
Average per cent moisture	10.0	11.0	
Total dry tons milled	75,710	87,900	
Average tons per day milled (365 days)	207	240	
Average tons per day milled, full running time (270.91 days)	279		
Average tons per day milled, full running time (283.02 days)		310	
Average tons per day milled, per 1,850-lb. stamp	13.9	15.5	
Number of 1,850 lb. stamps	20	20	

Recovery		1924	1923
Average ounces silver received, per ton	31.855	25.894	
Total ounces silver received	2,411,742	2,276,082	
Average ounces silver recovered, per ton	28.886	23.146	
Total ounces silver recovered	2,186,991	2,034,492	
Average silver recovery, per cent	90.68	89.39	
Average ounces gold received, per ton	0.0618	0.0575	
Total ounces gold received	4,678	5,051	
Average ounces gold recovered, per ton	0.0585	0.0532	
Total ounces gold recovered	4,426	4,679	
Average gold recovery, per cent	94.61	92.64	

	Supplies Used		1924		1923	
	Per Ton Ore	Crushed Tonnage	Per Oz. Fine Bul'n Produced	Grade of Ore	Per Oz. Fine Bul'n Produced	Grade of Ore
	75,710	87,900	Ag. 31.855	Ag. 25.894	Ag. 0.0618	Ag. 0.0575
Cyanide, 96-98, lb.	1.9442	1.716	0.067171	0.073965		
Cyanide, 48, lb.	8.0875	5.869	0.279410	0.252971		
Cyanide, 37-41, lb.		0.0364		0.001569		
Zinc dust	1.3710	1.052	0.047365	0.043356		
Muriatic acid	0.0763	0.0862	0.0022638	0.003715		
Lime	16.2574	14.715	0.561669	0.624306		
Borax	0.1012	0.0633	0.003495	0.002729		
Soda	0.0498	0.0292	0.001720	0.001258		
Fuel oil, gal.	0.0911	0.0872	0.003149	0.003760		
Artificial pebbles, lb.	95.2318	96.656	3.290109	4.166448		
Foreign pebbles, lb.	1.5138	1.751	0.052300	0.075500		

The recovery of 90.68 per cent of the silver and 94.16 per cent of the gold during 1924 represents a new recovery record for the present mill. The following comparative statement shows the percentage of value extraction by each of the three principal cyanide treatment stages. It will be noted that the higher recovery by 1.97 per cent of the silver and 1.36 per cent of the gold in 1924 is due to a combination of better extraction and a decrease in dissolved value loss.

	1924		1923	
	Hr. Min.	Per Cent	Hr. Min.	Per Cent
Extraction by Crushing Solution	9 00	37.70	9 00	40.58
Extraction by Agitation	78 45	52.70	75 00	49.23
Extraction in Slimes Presses	1 15	1.09	1 15	.86
Total	89 00	91.49	85 15	90.67
Less Dissolved Value Loss		.81		1.28
Recovery		90.68		89.39

To further increase the percentage of value recovery or at least maintain present recovery figures on a larger tonnage milling basis, new additions to the plant have been necessary. These are: One 4x10-ft. ball mill to increase fineness of grinding. This is already installed but as yet not in operation. Two high agitation tanks to permit a longer period of treatment and one 500-cu.ft. air compressor to supply the additional air required by increased agitation tank capacity.

The cost of producing one bar Doré bullion from precipitates was, in 1924, \$9.65 as against \$9.36 in 1923. In the coming year a substantial shipment of precipitates is to be made and the cost compared with that of shipping Doré bars. If an important saving is indicated the product will then be shipped as precipitates as was the case in former years.

Discussion

Advocates Tariff on Crude Feldspar

THE EDITOR:

Sir—In your issue of July 11 you mention the big increase in feldspar production in 1924 over previous years. One point you did not refer to is the gain of one feldspar-producing state, South Dakota, as compared with 1923. The principal reason for this gain is found in the high quality of Black Hills feldspars. Tests made by Arthus S. Watts of Columbus University have proved the Pringle and Keystone South Dakota feldspars to be of the very highest quality, some samples showing 11.63 per cent and 11.31 per cent potash and 2.8 per cent and 3.64 per cent soda. His report states that the feldspar when fused is exceptionally transparent and remarkably free from color.

During the year 1924 much prospecting of coarse pegmatites was carried on in the endeavor to find coarsely crystallized feldspar suitable for commercial extraction. Waste dumps were examined and about 2,000 tons was shipped from Keystone, this material having been obtained chiefly from the old dumps of the Hugo and Etta mines. The Keystone Feldspar & Chemical Co. is now operating successfully with a steady market, a better understanding as to required quantity, and with improving labor. The crude material is shipped to Murphysboro, Ill., to the grinding plant and from there distributed to the pottery and enamel trade.

The Dakota Feldspar Co., organized to develop some of the deposits of the Black Hills, has begun operations at Pringle, S. D. It expects to ship feldspar within ninety days.

At present there are at least fifteen districts in the eastern part of the United States from which a commercial grade of feldspar is obtainable. Nevertheless in the relatively short time that the supply of feldspar in the United States has been drawn on, the high-grade material has been almost totally exhausted in some districts and seriously depleted in other districts. As a matter of fact, large deposits of strictly No. 1 grade of feldspar in the East are scarce, and for this reason No. 1 feldspar (not containing more than 10 per cent free quartz) commands a higher price than it has in the past. The depletion of high-grade potash feldspar has placed the South Dakota feldspar deposits prominently in the limelight. The establishing of a commodity freight rate of \$7 to Chicago and \$9.10 to Cleveland, Ohio, and \$5.60 to Murphysboro, Ill., enables the owners of feldspar deposits to ship at a reasonable profit. A 30 per cent duty on ground Canadian feldspar has been established, but as the American owners of Canadian mines have bodily transplanted their grinding mills from Canada to the States, approximately 30,000 tons of potash feldspar is shipped to Ohio and New York grinding mills, obviously holding back the development of the South Dakota deposits. A \$2 to \$3 tariff on crude feldspar would protect an infant industry in the true sense of the word.

Referring again to the Geological Survey figures of June 25; the average value of ground domestic feldspar is given as \$16.84 per ton, whereas the average value of

ground Canadian feldspar was \$20.21 per ton, and ground in two states, New York and Ohio. The highest quotations in *Mining Journal-Press* of July 4 for ground feldspar are from Connecticut \$16 to \$30 per ton and from Virginia \$22 to \$23 per ton. The other quotations fall below the Canadian level.

It is evident that the duty-free crude imported feldspar from Canada can be replaced by American-mined feldspar of as good grade, and a brief advocating a tariff and containing past and present production of feldspar and other factors bearing on the case should be presented at the next session of Congress.

Rapid City, S. D.

A. T. Roos.

Hydrocarbon Veindikes and Oil Shales

THE EDITOR:

Sir—In his second letter on this subject, Mr. Hixon seems to want a further statement from me, which I will make as brief as possible.

1. My statement as to the rocks which inclose the gilsonite veins of northeast Utah was based on personal knowledge.

2. The region in which such veins occur is large, and covers possibly more than a thousand square miles. I have not studied all of it.

I admit that in daily life we have often to act on second-hand information, especially in unimportant matters. But it seems to me that when one advances a novel and startling hypothesis to explain a geological condition, it is incumbent on one to make sure first that the condition exists.

I am paying Mr. Hixon (for whose suggestion along other lines I have great respect) the courtesy of assuming that the basis for his hypothesis was second-hand, and not merely hypothetical.

GEORGE E. COLLINS.

Denver, Colo.

Consultation

High Prices Stimulate Interest in Bismuth

"Will you kindly direct me to information pertaining to the buyers of refined bismuth? Any additional information regarding the market and trade in this metal, here or abroad, will be greatly appreciated."

"I would be pleased if you would give me some information on the market for bismuth, as follows: 1. Marketable in what form. 2. By whom market is controlled. 3. Approximate consumption per annum."

"What per cent would a deposit of bismuth have to carry to pay for mining? Is there a market for bismuth in quantities, and can you send me the names and addresses of dealers to whom I can write and send samples and get other information?"

Bismuth has doubled in price in the last six months, which no doubt has occasioned the interest in this metal evidenced by the three inquiries given above, two of which were from Ontario and the other from Minnesota. Several interesting articles have been pub-

lished on the distribution, production, and marketing of bismuth, the most important recent ones that have come to our notice being a bulletin entitled "Bismuth Ores," published by the Imperial Institute and obtainable for 3s. 10d. from John Murray, Albemarle St., London W. 1, England; one by Victor C. Heikes entitled "Bismuth, Selenium, and Tellurium in 1922," published by and obtainable free of charge from the U. S. Geological Survey, Washington, D. C.; and "The Marketing of Bismuth," by Hamilton M. Brush, which was published in *Mining Journal-Press*, Feb. 10, 1923. A revision of this article appears in the book recently published by the McGraw-Hill Book Co., New York, at \$6, entitled "The Marketing of Metals and Minerals." The chapters of bismuth in "Mineral Industry," by C. P. Linville, also contain much of interest. All of these sources have been drawn on in compiling the following information:

The principal bismuth-producing country is Bolivia, where the metal occurs native and as the sulphide, bismuthinite, largely associated with cassiterite-bearing veins in the eastern Andes. In Australia, commercial production of native bismuth and its sulphide has been made from deposits associated with molybdenite and wolframite. In Germany, it is associated with silver and cobalt-silver lodes. Quite a bit is present in northern Rhodesia, including that on the property of Tanganyika Concessions. A recent development of commercial importance is the concentration and shipment of pure bismuth ore from the wolframite placer deposits of southern China. In the United States, bismuth is almost entirely a lead-refinery byproduct, no ores being sold chiefly for their bismuth content so far as has been reported, though at times in the past small tonnages of high-bismuth ores have been marketed. The chief occurrences are in Utah, in the mines of the Tintic, Little Cottonwood, and Clifton districts, and in the San Francisco and Granite districts of Beaver County. In Nevada, occurrences are reported in the Hilltop district near Battle Mountain, and in the Eureka, Luning, and Pioche districts. Other deposits are in the property of the Royal Tiger mines, in the Breckenridge district of Colorado, at Leadville, Colo., near Engle, N. M., and in Yuma County, Arizona.

Generally 3 per cent bismuth is required in an ore or concentrate containing other metals before a lead smelter in the United States will pay for it. Occasionally small amounts of bismuth are penalized; at other times its presence is desired and lower treatment charges can be obtained when a little bismuth is present. Bolivian ore containing 20 per cent bismuth has been exported, and the concentrates carry about 60 per cent. Ore containing as low as 2 to 3 per cent has been leached. In Peru, ore is mined that contains $1\frac{1}{2}$ to 2 per cent bismuth, and is concentrated to 20 per cent. Chinese concentrates contain 50 to 65 per cent. Usually other minerals are present, so that the profit to be derived from the sale of ore or concentrates does not depend entirely upon the bismuth content.

Four bismuth minerals are of common occurrence—native bismuth, sp.gr. 9.7, usually in irregular masses; bismuthinite, sp.gr. 6.4, occurring in fine hairlike crystals, in fibrous masses, or in masses showing more or less crystal form and having a well-developed cleavage, steel-gray in color, with a high metallic luster; bismite, or bismuth ocher, sp.gr. 4.3, the oxide of bismuth and very soft; and bismutite, sp.gr. 6.9, the basic carbonate,

also very soft. Both bismite and bismutite occur as gray, green, or yellowish nodules. Some bismite is of fibrous structure. A simple field test is to dissolve a fragment of the mineral in cold hydrochloric acid and then add an excess of water to the solution; a white precipitate indicates the presence of bismuth. A simple blowpipe test is to heat the mineral on charcoal with a mixture of potassium iodide and charcoal; a brilliant scarlet incrustation indicates bismuth.

Bismuth minerals are usually brittle and slime readily. They are usually concentrated, along with their associated minerals, by jigs, tables or flotation; or where the associated minerals are magnetic, by magnetic separators. The best description of the metallurgy of bismuth ores is given in the Imperial Institute bulletin mentioned before.

In the United States, most of the bismuth is recovered by the American Smelting & Refining Co., at Omaha, Neb., and by the United States Smelting, Refining & Mining Co., at East Chicago, Ind., by the Betts process of electrolytic lead refining. All the bullion at the East Chicago plant is refined by this method, and all of the high-bismuth bullion at Omaha. Any smelter that ships to these refineries is a potential buyer of bismuth ore.

Most of the bismuth used in the world is refined in England, by a group of refiners known as the Bismuth Association, working with and under the direction of Johnson, Matthey & Co., Ltd., of London. The association commands the market, buying only such quantities of ore as it desires and selling the metal at a fixed price, which it changes as it sees fit. In twenty-eight years the price has varied between 5s. and 12s. 6d. On March 2 last, the association marked the price up from 5s. to 7s. 6d., and on July 1 marked it up to 10s. The American price conforms exactly to the London price, taking into consideration the value of sterling exchange. Until March 2 it was \$1.30 to \$1.35 per pound, advancing then to \$1.95, and on July 1 to \$2.65@ \$2.70.

Refined bismuth is marketed in 25-lb. bars, six bars to a wooden box, separated by wooden wedges to prevent breakage. The refined metal is 99.9 per cent pure, and arsenic must be absent when sold, as it usually is, for medicinal chemicals, chiefly for alleviating indigestion. For other purposes, such as for the manufacture of fusible alloys, its only other important use, so high a degree of purity is not required.

The principal buyer of refined bismuth in the United States is the Mallinckrodt Chemical Works, St. Louis, Mo. Other important buyers for chemical purposes are the Powers-Weightman-Rosengarten Co., of Philadelphia, and Merck & Co., and Charles Pfizer & Co., of New York. The Federated Metals Corporation, of New York, uses bismuth in making fusible alloys, and there are numerous other small buyers for this purpose. These fusible alloys are used in automatic sprinklers, for safety plugs in boilers and coffee percolators, for setting radio crystals, and in dentistry.

United States consumption of bismuth has been estimated to be from 200,000 to 300,000 lb. yearly, one-fourth to one-half being imported, the present rate of duty being $7\frac{1}{2}$ per cent ad valorem. World production figures are apparently carefully concealed by the Bismuth Association, and no estimates are available. Production is regulated to meet the demand at the desired price.

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

CASE of Wolf Mineral Process vs. Minerals Separation dismissed by Judge Soper, U. S. District Court of Maryland, Aug. 8.

West Kootenay Power Co. completes its first unit of 40,000 hp. hydro-electric plant at Lower Bonnington Falls, B. C.

Deadwood, S. D., celebrates the fiftieth anniversary of the discovery of gold in the Black Hills.

Oronogo Mill, in the Joplin district, destroyed by fire. Not expected to be replaced.

Gold Hunter Mines, Inc., acquires Atlas holdings in Coeur d'Alene district.

Federal government seeks to cancel placer claims along Colorado River on basis of fraudulent acquisition.

Interstate Commerce Commission nearing completion of its work of establishing railroad valuations.

Silver mine valuation ruling by Commissioner of Internal Revenue still in abeyance.

Lena Goldfields, Ltd., secures a fifty-year mining concession from Soviet Russia.

Western railroads asking increased freight rates on all commodities.

Federal M. & S. Co. begins construction of concentrating plant at Granby, Mo.

Wolf Mineral Process vs. Minerals Separation

On Aug. 8 Judge Soper of the U. S. District Court for the District of Maryland filed an opinion in the action of Wolf Mineral Process Corporation vs. Minerals Separation North American Corporation.

There were two causes of action in the bill of complaint. The first charge was that the defendant had infringed the Wolf patent and in addition had licensed other persons to use the process. The second cause of action was based upon a charge of fraud. The opinion states:

"Careful consideration of the evidence requires the finding that so far as the second cause of action is concerned, the charge of fraud on the part of the defendant, and the claim of equitable ownership by Wolf and the plaintiff of the patent of the defendant, is without foundation. The truth would seem to be that Wolf had a certain proximity of time and place to the discovery, but no mental conception which contributed to the new invention, or facilitated its disclosure.

"In view of this finding, it is unnecessary to discuss certain affirmative defenses set up by the defendant . . .

"The charge of infringement fails, and it is not necessary to consider the defenses of laches, or *res adjudicata*, or that Wolf himself is not the first true and original inventor of the patent in suit, largely if not wholly based, as it was, upon the work of Sulman, Picard and Chapman. Nor is it necessary to consider the responsibility of

Bank Deposits \$333 per Capita in Michigan Copper District

EVIDENCE that prosperity is returning to the Michigan copper district, despite a shrunken population, is seen in a report of State and National banks in Houghton county, deposits of which, on June 30, 1925, totaled \$20,012,048.25. Present per capita deposits are better than \$333, based on a population of 60,000. Only a few years ago the mines of the district employed 18,000 men and the population was close to 100,000. Business has revived, and some of the mines have reopened idle shafts.

the defendant for the acts of its licensees.

"The bill of complaint will be dismissed."

Deadwood Celebrates Golden Anniversary

Deadwood, South Dakota, donned the garb of half a century ago to re-enact as nearly as possible the outstanding events of the early days of the gold rush to the Black Hills. The old-time long-whiskered prospector, the overland stage-coach, the early freight wagons, the log cabin, the sa'oon, the dance hall and typical characters of the time and place were each reproduced as nearly as possible, recalling those days of the mad scramble for gold.

First Unit of West Kootenay Power Plant Completed

The West Kootenay Power & Light Co. has started the first 40,000-hp. unit of the hydro-electric installation at Lower Bonnington Falls, B. C. This completes the company's present plans and brings the combined capacity of the two Bonnington Falls plants up to 72,000 hp.

T. D. Pattullo, Minister of Lands, in the presence of 500 invited guests, threw in the switch that put the plant in operation, and at the banquet that followed telegrams of congratulation were read from John Oliver, Premier of British Columbia, and William Sloan, Minister of Mines. Besides supplying a large number of towns and smaller communities with light and power, the West Kootenay company, which is a subsidiary of the Consolidated Mining & Smelting Company of Canada, provides the current that operates so many of the departments at the Trail smelter and the Allenby Copper Corporation's mine at Copper Mountain, and mill at Allenby.

Riparian Damage by Lake Gogebic, Michigan

The Victoria Copper Mining Company may be forced, through joint action of the Gogebic and Ontonagon county boards of supervisors, to reduce the water level of Lake Gogebic by removing the Victoria mine dam. It is contended that the dam is the cause of the high water level of the lake, which is doing considerable damage to property along the shore.

Oronogo Mill Destroyed by Fire

Fire of unknown origin completely destroyed the big concentrating plant of the Oronogo Circle mine, at Oronogo, Mo., in the Joplin-Miami district, on Aug. 9. The mill was erected in 1917 and 1918 by the Connecticut Zinc & Lead Corporation, and was the largest in the field. It did not prove profitable in operation, and after the company had spent approximately one million dollars on the property, a receivership was brought about and the mill has been idle most of the time since it was completed. Recently it was sold to Lauren R. Reynolds for wrecking purposes. He carried a \$15,000 insurance policy on it.

Some sentimental interest attaches to the property as it was one of the most noted in the district. For forty years it has been producing zinc and lead, and when the Connecticut Z. & L. Corp. took it over and spent so much money on it there was a feeling that it was the last stand of the sheet ground properties against the richer mines of the Oklahoma field. There is, of course, no probability that the plant will be rebuilt.

Superior & Boston Developing Recent Discovery in Old Dominion Vein

Copper-silver ore has been struck recently in the Old Dominion, or North Vein, above the 800-ft. level. The ore has been opened for a distance of approximately 100-ft., and appears to average about 4 per cent copper and 11 oz. silver. The vein at this point is near the eastern end of the mine, and the work is approaching 2,500 ft. of unexplored territory, so that the extent and significance of the ore strike cannot be determined as yet. The main shaft of the mine (McGaw shaft), after being unwatered and retimbered to the 1,400-ft. level, has been sunk to the 1,600-ft. level. It is planned to cut a station and crosscut to the Old Dominion vein on the 1,700-ft. level.

Rico-Argentine Mines Resume Work

Mining at Rico, Colo., as the result of the raising of the ban on lead-zinc ores by Utah smelters, is undergoing a revival. The Rico-Argentine is producing steadily. Workings are being cleaned and a new tramway has been built. By the first of September the management hopes to have the mine shipping 50 tons daily to a Salt Lake valley smelter. Sufficient tonnage has been developed in past years to maintain shipments for an indefinite period.

The Falcon Lead recently shipped a carload of ore to the smelter. Other active properties are the Silver Swan, the Argentine shaft, the Lily D., the Bertha S., the Rohde, and the Burns.

St. Joseph Lead Co. Moves to New Offices

The St. Joseph Lead Co., 60 Wall St., New York City, has moved its executive, sales, and exploration departments to 250 Park Ave., New York City.

Tri-State Zinc and Lead Association at Picher, Okla.

THE Tri-State Zinc and Lead Ore Producers' Association has moved into its new office building, recently completed at Picher, Okla., at a cost of \$10,000.

Previously the association had its headquarters at Miami, Okla., but it was felt Picher was a more convenient meeting point. The building is just across the street from the building of the Tri-State branch of the American Zinc Institute. It is a commodious structure, with three office rooms, a general office, a directors' room, and a record room. It is roofed with zinc shingles.

Federal M. & S. Co. Begins Work on Concentrating Plant

The Federal Mining & Smelting Co. has begun the erection of a concentrating plant at Granby, Mo., in the Joplin-Miami district.

The new mill is the result of negotiations entered into early this year, when the Federal took a drilling option on 6,000 acres of land held in the Granby section by the American Zinc, Lead & Smelting Co. The option later was closed, and drilling has been continued. The new mill will probably be as large as the Federal's Brewster mill in the Oklahoma field, and both the upper level and lower level of ore formations, disclosed by drilling, will be worked.

Gilbert-Mammoth Mines Make First Shipment

The Gilbert-Mammoth Last Hope Mines Co., the pioneer company of the new gold camp of Gilbert, Nev., made its initial ore shipment of 57 tons from its Mammoth mine early in August. The net returns to the company were \$4,841.68. This ore was sorted out in the course of development during the past several months.

About one and one-half tons of high-grade ore, said to be worth \$1 per pound, has been stored by this same company in bank vaults in Tonopah. This ore was hauled into Tonopah from Gilbert. Considerable work is being carried on in Gilbert.

Freight Handled by Railroads

THE Department of Commerce has issued a statement showing the classification of freight handled by railroads, of which amount the product of the mines represents 51.33 per cent.

Agricultural products, per cent.	10.63
Animals and products.....	2.23
Forest products.....	9.64
Manufactures and miscellaneous	26.17
Mines—	
Anthracite coal.....	5.68
Bituminous coal.....	28.45
Iron ore.....	4.23
Clay, sand, gravel, stone	8.67
All other.....	4.30
Total	100.00

Anna Beaver Mine Ships 1,000 Tons Lead Ore in July

Almost 1,000 tons of lead ore was produced and shipped by the Anna Beaver Mining Co., from its lease near Cardin, Okla., in the Joplin-Miami district, during the month of July.

In addition to this lead production, valued at about \$100,000, the mine turned out more than 1,300 tons of zinc concentrates, worth about \$65,000. This, however, is not a heavy production for a zinc mine in this field just now, but the Anna Beaver is the largest lead producer in the district.

Tonopah Western Provides \$100,000 for Early Exploration

The Tonopah Western Consolidated Mining Co., owning about 1,000 acres of mineral ground in the western part of the Tonopah mining district, plans to start work in the near future. A block of 500,000 shares of treasury stock is to be offered to present stockholders at 20c. per share. This block has been underwritten by the East Butte Copper Co., which controls the Tonopah Western.

The property owned by the Tonopah Western adjoins the Tonopah Extension on the west, and the West End Extension, Tonopah, Keystone and other properties on the north. There are two shafts: the great Western, down 1,133 ft., from which there is a small amount of development work, and the Tonopah Bonanza, which is down 1,680 ft. Water interfered with operations, and resulted in a discontinuance of operations.

The Tonopah Extension Diesel plant has been completed and is in operation, and this company has started drainage of its western area. Under these conditions the Tonopah Western officials consider this an opportune time to resume work.

Empire Mines Conducting Important Development Work

Four headings are being driven on the 1,800-ft. level of the Empire mines, near Eureka, Utah. Drifts are being driven north and south on a 30-ft. fissure. On the 1,200 level, a drift is being run to open up the downward extension of Black Jack deposit, productive near the surface in early days. Development of the mine has been largely financed by the sale of a stock interest in the company to the Tintic Standard Mining Co. Control is held by the Knight interests.

United Eastern Purchases 500 Acres at Jarbidge, Nev.

It is reported that the United Eastern Mining Co., of Oatman, Ariz., has purchased over 500 acres of mining ground in the Jarbidge district, in northern Nevada, and will start operations at once.

The area includes the Bluster Consolidated, Success, and Pick and Shovel mines, and is about two miles from the producing Elkoro Mines. The properties are all opened by tunnels, and an aerial tram is used for transporting ore from the mine to the mill.

Gold Hunter Mines, Inc., Acquires Atlas Holdings

THE GOLD HUNTER MINES, INC., formerly Gold Hunter Mining & Smelting Co., has taken control of the Atlas Mining Co., which owns a large group of claims joining the Hunter, in the Coeur d'Alene district. The Atlas Mining Co. was organized about a year ago by W. Earl Greenough, after he had succeeded in consolidating the Carbonate Hill, Idaho Giant, Boulder Creek, and Horseshoe groups of contiguous claims, making a large area of great prospective value. The Atlas ground joins the Gold Hunter, and the portal of the crosscut is 2,400 ft. from the Gold Hunter mill. The special interest in the Atlas enterprise lies in the fact that it is in what is locally known as the south side mineral belt, in which no extensive orebodies have been found and which has to some extent been tabooed by expert geological opinion. Mr. Greenough and other engineers, after exhaustive investigation, are convinced that deep development will disclose large bodies of commercial ore. The Gold Hunter management concurs in this view and is well equipped to carry the big enterprise to a conclusion.

Increased Price of Lead Stimulates Colorado Mining

The increase in the price of lead has resulted in renewed activity in many of the Colorado mines wherein lead is one of the principal products. Leadville ore shipments are now placed at 40 per cent in excess of August, 1924, by the officials of the Denver & Rio Grande Western, who handle the traffic.

Mines in Clear Creek, Summit, Eagle, and Hinsdale counties, and in the San Juan camps of Ophir, Rico, Silverton, and Creede, are especially stimulated by the advance in lead. This is also true as to mines in Gunnison and Chaffee counties. In Aspen, where half the value from the mines is lead, the advance in price will speed up large development now under way, with Pittsburgh capital in charge.

Trinity River Placer Mines, Inc., Begins Operations

The Beaudry mining ground, a tract of nearly 4,000 acres near Minersville, Trinity County, Calif., which has not been worked for more than seven years owing to litigation, is now being opened up by a group of New York capitalists under the leadership of H. S. Stowe, of San Francisco. The property is owned by Mrs. Louis Bazet, of San Francisco.

Thirty-five hundred acres of the land is suitable for hydraulicking; the remainder can best be worked by dredges. Hydraulicking will be begun first. Stowe took charge of the property on July 1. He now has twenty men at work.

Iron Mountain Mining Co. Incorporates

Glenn Anderson, consulting engineer for the Butte Copper & Zinc Co., Raymond E. Tower, of Butte, and New York associates, represented by Solomon Grossbard, mining engineer, have incorporated the Iron Mountain Mining Co. to work the Iron Mountain mine, near Superior, Mont. The mine is opened by a 3,000-ft. tunnel cross-cutting several zinc-lead-silver veins. The company has made arrangements with the Montana Power Co. and the Milwaukee Railroad to tie into the Milwaukee power line at Superior, the power to be transformed from 110,000 to 2,200 volts and then transmitted three miles to the mine. A contract has been let to the Butte Machinery Co. covering the purchase of complete mining machinery and a 100-ton milling equipment.

Exploration of Aztec Vein, Oatman, Ariz.

The lessors on the Aztec vein of the Tom Reed property near Oatman, Ariz., are now operating seven drills on development and in the stopes and are sending from 40 to 50 tons of ore to the Tom Reed mill for treatment daily. Most of the production is coming from the stope at the east end of the property where it adjoins the United American. The owners of the lease plan to sink a winze to explore the downward extension of the shoot. The rich ore from this lease has led the United American company to drift toward the ore shoot from the east on the United's 775-ft. level. As soon as this drift connects with the Aztec workings stoping will be started on the east side of the common property line by the United American company and the ore will be sent to the Tom Reed mill. The Gold Dust mine recently started operations with a crew of twelve men. This property has a mill of its own, which will be put into operation after being overhauled and altered to permit the use of cyanide.

East Standard Mine Sinking 1,000-Ft. Shaft

Sinking operations have been resumed on the property of the East Standard mine, adjoining the Tintic Standard near Eureka, Utah. The shaft, now down 554 ft., will be sunk to the 1,000-ft. level, according to plans of the company, and drifting to seek the extension of the Tintic Standard ore channel will be undertaken. The property is equipped with electrical hoist and compressor.

Premier Gold, B. C., to Add a Second Unit to Mill

R. W. Wood, president of the Premier Gold Mining Co., has announced that the company will start immediately on the erection of a second unit to its mill, which will bring the capacity up to 400 tons per day. This has been rendered necessary on account of the lower grade of the ore in the deeper workings, and consequently the smaller proportion of shipping to milling ore.

Revival of the Alma Mining District, Colorado

By Theodore A. Woodruff

The town of Alma, seventeen miles east of Leadville, was located in 1873, and among its first settlers was Dan O'Connell, a miner who still lives at Alma and who gave the writer much history of the district. The ore near the surface is a free milling gold quartz and considerable money was made from lode and placer mining. The farmers objected to hydraulicking, and that put an end to placer mining, and it also "killed the goose that laid the golden egg," as it shut off the farmers' ready and nearby market, with its big prices. At depth the ores in the quartz mines changed from free milling to complex, copper-zinc-lead carrying gold, but the smelters at that time could not treat such ores. The ore was penalized so that the mines were compelled to close down. It is different now, as complex ores are at present being successfully treated at a profit. The high price of lead and also payments for the copper-zinc and lead contents in complex ores will do much to open up these mines, which have large quantities of ore in sight that was worthless in the early days.

Alma may be reached by railroad, or by auto on the public highway. The best auto route from Denver is via Morrison to Bailey, where there are hotel accommodations at reasonable prices. Thence from Bailey, via Fair Play, to Alma. The London Mines cyanide mill is on the north side of the mountain. The mine is opened by tunnel from both the south and north sides. There are seventeen cyanide tanks in the mill, which has a capacity of about 300 tons per day. The mine and mill on the north side are closed down preparatory to putting in a flotation process and concentrating tables in addition to that of the cyanide plant. The ores have changed their character at depth and now carry considerable lead as well as gold. An aerial tram conveys the ore from the mine to the cyanide mill, which is at an altitude of 11,642 ft. above sea level; that of the mine on the south side of the mountain is 12,500 ft.

Development work is being carried on in a tunnel on the south side of London Mountain on ore 600 ft. vertically below the tunnel above. The orebody is several feet in thickness and assays high in gold. It is stated that the mine has produced more than \$10,000,000 in gold, and there is a large amount of ore in sight between the 600- and the 1,200-ft. levels. There is a wagon road from both the south and north sides of London Mountain leading into Leadville, via Big Evans Gulch, but about two miles of it, up the mountain at more than 13,000 ft. altitude, is quite rough and as late as June 25 was filled with snow from 2 to 3 ft. deep, so that an automobile or wagon cannot get through. There is, however, a possibility of making this a public highway in the near future, which will assist much in reopening these promising ore deposits.

Federal Government Seeks to Cancel Placer Claims Along Colorado River

A suit in equity has been filed in the United States District Court at Phoenix, Arizona, against Ralph H. Cameron, Jr., son of Senator Cameron, Ida M. Cameron, G. H. Stetson, of Philadelphia, and associates, asking for the cancellation of 55 placer mining entries, held by the defendants along the Colorado River, on the grounds of fraud. The complaint, which was filed by John G. Sargent, Attorney General of the United States, through Harold Baxter, special assistant to the Attorney General, claims that the Black Canyon, Callville, and Boulder Canyon dam sites and reservoir areas on the Colorado River have been seized by a private group of individuals and possibly are not available for governmental construction of works of tremendous benefit to the Southwest. The 55 placer claims, each of more than 160 acres, extend down the river for 25 miles where the stream forms the boundary line between Clark County, Nevada, and Mohave County, Ariz.

In the complaint the government charges that the defendants fraudulently sought to secure to themselves possession, ownership, and control of the groups of pretended mining claims under the guise and pretext that they were bona-fide mining locations for the purpose of utilizing the water and water-power resources of the river at all the storage reservoirs and power dam-sites above named. These uses are declared "of enormous capacity and great monetary value and essential for such purposes to the welfare and safety of the plaintiff and the people of the United States."

Other Claims Involved

In the heart of the Grand Canyon, practically the same group is defendant in a suit to dispossess filed by the government with regard to fifty-five other placer claims, though in this case the mineral declared is platinum. On the southern rim is the Cape Horn claim, covering the ground occupied by the Harvey system, El Tovar Hotel, the Santa Fe terminal tracks and depot and the government's park offices and warehouses. Wholly within the group also is the seven-mile Bright Angel Trail to the river as well as Indian Gardens on the trail. Following contempt proceedings, Senator Cameron's assigns were ejected from Indian Gardens last October, on the basis of an order issued a short time before by the Judge of the United States Court at Tucson.

Still another Stetson group of twenty-eight claims, located under the placer laws, said to carry platinum, lies along the Colorado River above the Bright Angel group. An effort to dispossess is being made by the government at the present time with regard to this block of claims also. Some of this canyon litigation, usually with Ralph H. Cameron, Sr., as defendant, has been in the federal or state courts or in the land offices since January, 1907. Continuing through it all has been the governmental contention that the claims have little or no value for mineral contents.

Production of Yellow Pine Mining Co.

THE NET PROCEEDS of the Yellow Pine Mining Co., operating at Goodsprings, Nev., for the quarter ended June 30 amounted to \$22,993.17. Production was 2,722 tons of ore averaging \$27.19 a ton and having a gross value of \$74,326.34. Deductions of \$51,333.17 included charges for management of \$6,359.04, mining \$33,281.19, transportation \$6,404.61, reduction and sales \$5,288.33. Bullion tax paid was \$686.34.

Tonopah-Canadian Mines Options 500 Acres in Gowganda

The Tonopah Canadian Mines, a subsidiary of the Tonopah Mining Co., will continue the main shaft on the Walsh property, from 330 to 480 ft. The company has 500 acres under option in the Gowganda section and has developed several veins bearing substantial quantities of high-grade ore. Two shipments of about six tons each have already been made, and the property should be on a regular producing basis in the comparatively near future.

The Keeley Silver Mines has taken an option on the Cariboo claims in South Lorrain and has made a contract for diamond drilling. The property adjoins the north holdings of the Mining Corporation.

The long-lost contact of the Capitol property, in Gowganda, has finally been found by diamond drilling, at a depth of 1,036 ft. While this contact is considerably lower than anticipated, it is not an unfavorable condition.

Operations looking toward the re-opening of the Beaver Auxiliary property in Elk Lake have been started and the property has been dewatered. The main shaft is down 325 ft., and in this working some rich ore was encountered.

Nipissing Central Railway Completed to Quebec-Ontario Boundary

The last rail on the branch of the Nipissing Central Railway up to the border between Quebec and Ontario was laid on Aug. 7. The Timiskaming & Northern Ontario Railway, with which the Nipissing Central connects, is preparing to give an efficient service over the line, which is expected to stimulate prospecting in the area lying between the Kirkland Lake field and the Rouyn gold area.

Vipond Mine Production in July Was \$48,000

During July, the Vipond mine, in Porcupine, Ont., produced \$48,000 from 5,361 tons. Drilling below the 1,000 level continues to be satisfactory, and another important discovery has been made by the finding of the upward extension of the central vein system on the 200 level. The diamond drill showed \$100 across 6 ft. on what is presumed to be the No. 10 vein, and the No. 10 vein intersection showed \$30 across 7 ft.

Canadian Associated Goldfields Encounters New Ore Veins

On the 1,000-ft. level of the Canadian Associated Goldfields property, in the Larder Lake district of Ontario, three new veins are reported to have been discovered, one being 8 ft. wide and carrying low values, while the second averaged \$24 across 12 ft., and the third \$15 across 16 ft. So far no drifting has been done, so it is impossible to estimate their importance, and what they might mean to the adjoining Crown Reserve property still remains to be discovered. Conditions at the Crown Reserve are understood to be far from satisfactory, as it is reported that below the 800-ft. level development has shown only a narrow width carrying no values.

Another new discovery has been reported on the Thorburn Veteran claim, which was recently purchased by a New York syndicate. A vein has been stripped for 400 ft., having a width of 14 to 20 in. and where shot into shows high values. This property adjoins the Gold Hill, which has been developed to a depth of 300 ft., at which depth a length of 250 ft. of narrow but good-grade ore has been disclosed. In the same district the Walsh-Katrine property is being developed and it is the intention to continue sinking from the 250-ft. level to 750 ft.

Gold and Copper Ore Discovered on Waite Claim in Rouyn

The latest discovery of importance in the Rouyn section would appear to be on the Waite claims carrying high-grade copper ore. The gold content so far is lower than the higher grade lenses of the Noranda, but the discovery appears to be very important, containing as it does a good percentage of copper.

It is understood that a discovery of considerable promise has been made on claims staked by the Mining Corporation in the Central Manitoba area, near the holdings of the "WAD" Syndicate. The "WAD" shaft is now down 375 ft., and crosscutting is to be started within the next few weeks. It is also understood that negotiations are under way for the purchase of the Flin Flon property of the Mining Corporation in northern Manitoba.

Noranda Mine Plans Flotation Plant and Smelter

An important strike of free milling gold ore has been made on the Horne property of the Noranda mine, in the Rouyn gold area of Quebec. An ore body having a width of 20 ft. was encountered in a crosscut between the two shafts at the 180-ft. level. Numerous channel samples show an average value of about \$45 to the ton. The length of the orebody has not been determined.

The diamond drilling program has been discontinued, as sufficient information has been obtained to warrant smelter operations on a large scale. It is proposed to establish a flotation plant in addition to the smelter, which, it has been definitely decided, will be located in Rouyn Township.

Washington News

By Paul Wooton
Special Correspondent

Increased Freight Rates Proposed —I.C.C. Valuation Work Nearing Completion

Silver Mine Revaluation Ruling in Abeyance—Bureau of Mines to Prepare Mineral Re- sources Reports

The western railroads initiated their freight rate increase, it is said, to offset the effort of the farm organizations to transfer a portion of the farmers' freight bill to other shippers. However it came about, it is certain that the western roads are preparing for a finished fight with the Interstate Commerce Commission.

While promising that established rate relationships will be maintained "as a matter of expediency in the instance of certain commodities, the carriers will propose that the percentage of advance be converted into one applicable in an equal amount to all rates." The carriers admit that this is going to mean 15c. more freight on each ton of coal—enough to alter the whole market situation of the producing districts. Nothing has been revealed as yet as to what flat rate of increase has been figured out for ores, concentrates, and other products of metal mines.

Ruling on Silver Mine Valuations in Abeyance

The finding of the Commissioner of Internal Revenue in the matter of revaluing silver mines is nearing completion, he states, but no date for its handing down has been set. The brief of the metals valuation section reply to that submitted by the silver producers went forward promptly, it was stated, but its contents will not be divulged until the commissioner's decision is available.

The Coal Strike

As the breach widens between the anthracite operators and their men, and as the possibility increases that the bituminous union field may become involved, indications still are that federal intervention is going to be withheld more firmly than ever before. If there is federal action it is more likely to come from Congress than from executive officials. Even Congress is slow to take a hand in an industrial dispute, but it may have an opportunity to thrust in its arm earlier than Dec. 7, as the pressure for an extra session, so that tax revision may be taken up, is becoming increasingly great.

Observers in the executive departments, representing as they do the whole public, are disinclined to criticize either party to the existing controversy, but the coal specialists outside the government service are frank in expressing the opinion that the mine workers are deliberately picking a

quarrel. They believe Mr. Lewis's position with regard to the attendance of S. D. Warriner and W. J. Richards is untenable. There is general concurrence in the view that one party to a wage negotiation may not dictate who shall represent the other side any more than may one party to a business transaction pick the men with whom they will confer.

The anthracite decision of the Interstate Commerce Commission has taken the wind out of Mr. Lewis's sails in the matter of the joint application for reduced freight rates. It hardly is supposed that he will renew his proposal, as it obviously would be hopeless to go before the commission seeking a rate reduction when it just has been over the ground and has made a decision.

Mineral Resources Reports to Be Prepared by Bureau of Mines

The "Mineral Resources" reports which heretofore have been written by geologists of the U. S. Geological Survey, in the future will be written in the division of mineral technology of the Bureau of Mines. This division is to become the clearing house of the bureau for economic and scientific reports which are to be used in conjunction with the statistics of the Minerals Resources division. Some of the annual chapters will be written in the division of mineral resources, as F. J. Katz, F. G. Tryon, J. M. Hill, and Victor Heikes are geologists as well as statisticians.

The research work on the non-metallies will continue to form a part of the work of the technological division.

Bureau of Mines to Co-operate With University of Minnesota

Plans are being perfected for extensive co-operative work between the U. S. Bureau of Mines and the State of Minnesota on the concentration and beneficiation of low grade iron ore. Dorsey A. Lyon, acting director of the Bureau, has been in Minneapolis conferring with officials of the School of Mines and of the state experiment station.

Interstate Commerce Railroad Valuation Nearing Completion

After twelve years of intensive work, the valuation section of the Interstate Commerce Commission is beginning to see the end of its task. Two more fiscal years are expected to effect the completion of basic valuations. These will be values of certain dates and are regarded primarily as rate-making values. To date, \$25,000,000 has been spent on valuation. Several of the former Congressional opponents of the valuation effort now are said to be convinced that it is worth all its cost. The commission has made no estimate as to the total which the completed valuations will show. Outside estimates, however, based on the figures the commission has gathered, place the aggregate at from \$17,500,000,000 to \$20,000,000,000.

Alaskan Coal Mines Show High-Grade Coal Not Faulted

Development of Alaska coal mines is revealing that the deposits there are much more valuable than early prospecting indicated, according to O. P. Hood, of the Bureau of Mines, who visited the northern territory recently.

Development work at the several operating properties, Mr. Hood found, has uncovered high-grade coal that has not been seriously disturbed by faulting. Moreover, he feels that the chances favor the existence of even more favorable mining locations, as other coal deposits are worked.

Large dredging operations that are to begin next season will provide a new outlet for Alaska coal.

Standard Grades of Fertilizers Endorsed

Simplification of formula practice through the reduction of the number of grades of fertilizer was endorsed by the executive committee of the National Fertilizer Association on Aug. 6 when it met in Washington to make plans for the coming year. The executive committee is convinced that this offers one of the ways for cost reduction. The industry will co-operate more closely than ever with the standardization and simplification efforts of the Department of Commerce.

The committee commended, for the consideration of the legislatures in other states, the Alabama law which requires that all fertilizers distributed in that state must contain not less than sixteen units of plant food per ton, of which no less than two and one-half units must be nitrogen.

Revival of Copper Mining on Island of Cyprus

J. L. Bruce, Salt Lake consulting engineer, formerly general manager of the Butte-Superior and Davis-Daly mines at Butte, will sail from New York about the first of September for the Island of Cyprus to take charge of operations as general manager of the Cyprus Mines Corporation. The copper deposits of the island of Cyprus are being exploited by American capital headed by Seeley W. Mudd, of Los Angeles, and Philip Wiseman. It is probable that the Cyprus deposits were worked so early that the more accessible deposits were exhausted before written records were made, for Herodotus makes but brief mention of them.

The deposits are pyritic, and are being worked by tunnels. The ore carries from 1 to 4 per cent copper. It is not treated at the mine, but is shipped by railroad five miles to the coast, where it is consigned to French, German, and Spanish industrial centers. Production ranges from 500 to 1,000 tons daily.

Pekin Syndicate Mines Closed

The mines of the Pekin syndicate in Honan, China, have been closed on account of the civil disturbances in that country. The Kailan mines are still operating, but under great difficulties.

Mineral Resources of the Malibu Ranch, California

Promising Deposits of Oil Shale, Clay,
and Diatomaceous Earth in
Process of Development

BY E. B. FOSTER

Bulletin 753 of the United States Geological Survey, by William S. W. Kew, recently published, covers the Santa Monica Mountain region west of Los Angeles, but excludes a narrow strip known as the Rancho Malibu.

The ranch, which is one of the few California Spanish grants remaining intact, comprises about 23,000 acres of beach, mesa, and mountain territory situated between Santa Monica and Ventura. The ranch lies along the Pacific Ocean for 19 miles with a width ranging from $\frac{1}{2}$ to 3 miles. The area along the ocean consists of strips of beach sand with palisades rising abruptly 100 to 200 ft. high, topped by mesa lands sloping back for $\frac{1}{4}$ to 3 miles to the foothills and mountains of the Santa Monica Range.

The comparatively narrow strip of mesa land with an average elevation of 250 ft., along the ocean, is composed of lagoonal, diatomaceous shales of the Modelo (Upper Miocene) series, with one or two exposures of Topanga (Middle Miocene). Back and north of this strip the Vaqueros sandstone, the lowest Miocene member, has been broken off by the surge of the magma from under the ocean floor, orientated into a dip of 45 deg. to the north and overthrust approximately 8,000 ft. into their present position back of and on top of the Modelo member. Andesite from a few feet to 300 ft. in thickness fills the fault zone. This overthrust fault is exposed from Topango canyon on the east to Trances canyon on the west, a distance of more than 12 miles. The dip of the fault plane is approximately 70 deg. to the north, and nowhere do shales and sandstones lie in normal contact.

Large Shale Areas Exposed

The Modelo is practically all found dipping to the north at from 25 to 55 deg., but at Point Malibu the Modelo is exposed on the beach at low tide dipping to the south at 55 deg., showing the presence of at least one prominent fold in the ranch area. The geological conclusion seems justified by the facts that the shale area extends south from this exposure to the old Oligocene shore line now expressed by a scarp from 500 to 750 ft. high as shown on Geodetic Survey maps. In several places along the beach low tide uncovers Modelo shale. Between the old Oligocene shore line, probably igneous, and the overthrust fault there exists a normal fault paralleling the other, the Modelo faulting down on a fault plane dipping 70 deg. to the south.

Throughout the sandstone and shale area occurs a system of parallel dikes and flows, differentiated from the plastic core of the Santa Monica Mountain area as andesites, diabases, gabbros, and basalts, the whole occupying about one-tenth of the surface area. These dikes all dip parallel to the overthrust fault plant. Two prominent breccias

occur, covering large areas and effecting alteration of surrounding sedimentaries and in one case completely altering the diatomaceous shale to pure limestone.

A mantle of from 15 to 25 ft. of plastic clays covers a large part of the Modelo surface, representing a large tonnage suitable for red burning wares. Lower in the stratigraphic column occurs a sill of gray clay with an average thickness of 5 ft., suitable for high-grade glaze. Several million tons of this material is available, and extensive burning tests show it to be of superior quality.

The diatomaceous shales contain kerogen and yield, on destructive distillation, upward of 12 gal. of oil rich in nitrogen compounds, 10 per cent fixed carbon, and 1,900 cu.ft. of fixed gas per ton of shale.

Three favorable oil structures were found where the porous Vaqueros sand-

Electricity an Aid to Prospecting

Exploring by electricity is the latest innovation in the Michigan copper district. An electric induction method devised by Swedish scientists is being used and representatives of a Swedish company are in charge of the work. The tests are largely of an experimental character, for this is the first time the method has been applied in a native-metal field. Good results have been obtained in sulphide ore districts, but whether similar success will be had in the Michigan district remains to be determined. The experiments are being carried out on lands of the Calumet & Hecla Consolidated and Copper Range companies, and it is understood some good reactions, indicating the presence of copper, have been recorded. Although the method apparently gives a favorable indication, it does not indicate quality, quantity, nor depth.



Point Malibu showing harbor area and kerogen shale exposures

stones or the lenticular Topanga sands still competently underlie the Modelo and appear to be within the reach of the drill. The areas involved would cover more than 1,000 acres. Localization of oil accumulations in the sandstones near dikes and flows may augment this area.

About 500 acres contain a blanket of pure, white diatomite, suitable for powder, sugar and oil refining, insulation, etc. This deposit of diatomite is on tidewater, and may be mined by steam shovel. A series of tests indicates that it will increase the efficiency of fuller's earth.

Mrs. Mary K. Ringe, president of the Marblehead Land Co., Los Angeles, has retained a staff of engineers and geologists to make a complete mineral survey of the area.

Tin Mining in Malaya in 1924

A survey of mining in Malaya during 1924 indicates an unusual prosperity for the tin industry as a whole throughout the period. The labor employed in mining tin and tungsten at the end of 1924 was 106,479, not including labor employed on cutting and transporting firewood. The total exports of refined tin from British Malaya during 1924 amounted to 80,674 long tons. The United States took 46,194 tons of the year's exports and Great Britain took 16,334 tons, the shipments to that country having increased steadily during recent years. About 70 per cent is reshipped to United States.

Decline in Spanish Iron and Steel Output Expected

The earnings of the Bilbao metallurgical industries during the first six months of 1925 have been equal to the rate established for the preceding six months, but unfilled orders show a considerable decline, according to the Department of Commerce. During the first half of 1925 Bilbao exported 370,000 metric tons of iron ore, as compared with 410,000 tons for the preceding half year.

Wages in Peru to Be Paid in Legal Currency Only

A bill has passed the Peru Chamber of Deputies that makes it unlawful for employers of labor to pay wages in anything but the legal currency of the nation. Its purpose is to prevent the alleged practice of some of the large employers of paying their employees with merchandise in such a manner that the wages are unjustly reduced.

Brazil Changes Basis for Export Tax on Manganese Ore

The State of Minas Geraes has passed a new law for the taxation of exports of manganese ore. The former tax was levied according to weight; by the present system a higher tax will be imposed on the high-grade ore, while the tax on low-grade ore has been reduced.

Johannesburg Letter

By John Watson
Special Correspondent

Johannesburg, July 14—The following crushing results, for the month of June, from fourteen leading gold-mining companies, arranged in order of profits earned, have recently been published:

	Tons Crushed	Revenue or Value £	Costs per Ton Milled s. d.	Esti- mated Profit £
Government Areas	157,000	293,127	16 11.1	162,245
New Modder Crown Mines	121,000	263,957	16 11.7	161,243
Modder Deep	42,500	96,242	15 8.0	63,002
Springs	61,500	119,100	20 8.5	55,415
Brakpan	78,200	126,718	19 7.1	50,100
Van Ryn Deep	65,200	103,030	16 10.0	49,271
New State Areas	71,000	119,519	20 2.1	48,191
Geduld	75,000	111,620	17 7.0	45,540
Modder B.	63,000	99,611	18 6.7	41,148
Randfontein Estates	182,500	210,833	19 0.4	40,151
City Deep	92,000	144,362	23 1.2	38,114
Robinson Deep	69,000		18 2.9	35,936
West Springs	46,200	73,782	17 8.2	32,941

In the Veld garden, adjoining the South African Pavilion at Wembley, a large pyramid of gold is exhibited, representing the output of the Rand mines last year (1924)—viz., 9,574,918 fine ounces. A smaller pyramid represents the 1887 output, which amounted to 39,880 oz.

The Transvaal gold output for the month of June was declared by the Chamber of Mines as 780,251 fine ounces, having a value of £3,314,296. Compared with May, this is a decrease of 32,998 oz., equal in value to £140,166. June had only twenty-five working days, there being a paid holiday on account of the visit of the Prince of Wales. Among the returns from individual mines, notable increases were shown by the Consolidated Main Reef and Luipaardsvlei.

The other mines, in the main, showed decreases, Crown Mines and New Modder being the most notable. The native labor returns showed 169,810 "boys" employed on the gold mines of the Witwatersrand on June 30, compared with 172,982 on May 31.

A. A. Thomson, of the Tanganyika Concessions, Ltd., was recently in Lourenco Margues (Delagoa Bay) on a visit from Elisabethville. The contract for the construction of the Benguela railway from the present terminus to the Congo border has been signed in London by Robert Williams, the concessionaire. The railway will extend 320 miles and should be completed by 1927. All the material has been placed on order with British firms. The country to be traversed is rich in timber.

The discovery of platinum in the Makurio district (Southern Rhodesia) was recently announced. Makurio is about midway between Salisbury and Gatooma. The London and Rhodesia Mining & Land Co., Ltd., has now taken up a six months' development option and is arranging for systematic prospecting over ninety-five blocks of claims, extending over an area of nine miles. Assays taken from various parts of the property up to date show results varying from a trace up to 33

dwt. platinoids per ton. The formation is said to be very similar to the Lydenburg norite.

I regret to announce the death of Fritz H. Reiss at Johannesburg, July 8. Mr. Reiss, since its inception, has been chairman of the Transvaal Platinum, Ltd. The late Mr. Reiss was a lawyer, of a genial disposition, and had many friends.

The annual congress of the South African Association for the Advancement of Science was held at Oudtshoorn (Cape Province) last week. The president this year is General Smuts, late Prime Minister of the Union and now leader of the opposition. In a brilliant address, the president showed that, besides his work as a lawyer, soldier and statesman, he has found time to take a great interest in such branches of science as physiography, geology, botany, meteorology, astronomy, and human evolution. General Smuts claimed a central position for South Africa in the hypothetical continent advanced by Wegener, in explaining the origin of the land masses and oceans, and its significant situation in the geologists' continent of Gondwanaland. In the address of Dr. A. L. du Toit, in 1921, to the same association, an illuminating account was given of Gondwanaland, its rise, decline, and fall. In concluding, General Smuts said: "The day when scientific progress in the broadest sense becomes a first-class concern for our people and our government will indeed be a red-letter day for the progress, as a whole, of South Africa. May we look forward to its speedy dawn!"

Lena Goldfields, Ltd., Secures 50-Year Concession From Soviet Government

A preliminary concessionary contract with the Lena Goldfields Co., of London, which was signed by the concession committee in April, was ratified Aug. 12, 1925, by the Council of Commissioners. Besides the political importance of the concession, which lies in the fact that it embraces a number of concerns previously owned in Russia by the same company, it is of great economic importance for the Soviet Union.

Not only is it the largest concession granted by the Soviet Government to foreign interests, but it is calculated to help Russia re-establish her metal industry by meeting her needs for copper, zinc, lead and coal.

The Lena Goldfields Corporation embraces also the interests of the Russian Mining Corporation, Ltd., the Altai Mines, Ltd., and the Sissert Co., which, with the Lena Goldfields Co., operated the mines covered by the present concession before the Russian revolution.

These mines, which now are operated by the Soviet Government, will be taken over immediately by the Anglo-American syndicate. The company's technical staff will be largely British and American. Under the terms of the contract the Soviet Government turns over to the company many steamers, steel barges and tugs for transportation on the Lena River. The company agrees to install \$7,000,000 worth of modern equipment, which will be largely of American manufacture.

London Letter

By W. A. Doman
Special Correspondent

London, Aug. 4—Shareholders in the Lena Goldfields have approved the arrangement made by the directors with the Soviet Government for the working of the concessions. The chairman, Herbert Guedalla, was hopeful, and yet there did not seem that confident ring about his speech that hearers would have wished. This is one of the first schemes agreed with the Soviet, and consequently it is of importance, as others may be built upon it. The properties, having been nationalized, are now leased again, and original shareholders must waive any claim for compensation. Compensation for loss of property and income is one of the bones of contention, and forms one of the chief reasons why new capital will not go into Russian enterprises. The Soviet Government now has a month in which to ratify the concession, so that there is no hurry in the matter. It has to look at the arrangement in the light of precedents that might be created. Herbert Guedalla looks rather at the spirit in which the agreement was arrived at than the actual wording of the various clauses, and he feels sure "that in any matter of construction we shall always be certain of a sympathetic hearing." This is what is necessary, and upon the action of the Soviet Government will presumably depend the attitude of other parties desirous of taking up concessions.

Seeing that the agreement runs to eighty-three pages, the provisions were only sketched, but it would have been interesting to get more information than was given concerning the government's right to take a certain proportion of the output upon payment therefor. Also the obligations with regard to capital expenditure, output and royalty. Much capital will be required to resume working of the properties, and this is presumably where the problem will arise, for unless conditions are wholly satisfactory British investors are likely to remain shy.

London has visitors from Johannesburg whose object is to fan the flame of interest in platinum shares. As before mentioned, many new companies have been formed, and as vendors have much paper, they seem anxious to convert a portion of it into cash. Almost anyone owning a farm in the Transvaal has been able to sell an option on it for platinum, and as a result there has been disappointment, various options having been abandoned. One or two companies seem to be making good discoveries, and it is on their success that others are being formed. Toward the end of the year it is expected that a couple of mines will be producing. The argument of Johannesburg firms that wish to sell shares is that the financial houses would not go into platinum unless they could foresee a profitable outcome. This, however, is not conclusive, seeing that a large proportion of their income is earned in the share market. The stimulus of platinum prospecting has crossed the border into Rhodesia.

Men You Should Know About

W. DeL. Benedict, of New York, is visiting friends in San Francisco.

C. B. Larsen, formerly at Jerome, with the United Verde Copper Co., has gone to Mexico City.

H. H. Knox, of Knox & Allen, is away from London for a three months' visit to the United States.

F. Lynwood Garrison, of Philadelphia, was in San Francisco recently, after examining mines at Eureka, Nevada.

W. Lee Heidenreich left New York on Aug. 15 for three months' mine examination work in British Columbia and Mexico.

F. W. Bradley returned recently to San Francisco from a visit to Nevada; he is now at the Bunker Hill & Sullivan mine, in Idaho.

W. H. Blackburn, consulting mining engineer of San Francisco, has been in Tonopah and other Nevada districts on professional work.

H. A. Guess is in Peru visiting the properties of the Northern Peru Mining & Smelting Co., of which company he is directing head.

F. D. Pagliuchi has returned to New York from Venezuela, where he examined gold-mining properties. He will go to Cuba late in August.

Paul T. Bruhl, mill superintendent of the New York & Honduras Rosario Mining Co., has arrived in New York for a three months' vacation.

Fred A. Starkey, of Nelson, B. C., will again represent the British Columbia Department of Mines at the British Empire Exhibition, at Wembley.

John A. Burgess, mining engineer of San Francisco, left that city on Aug. 5 for a five or six weeks' trip to Alaska to examine mining property in that territory.

James F. Kemp, professor of geology in Columbia University, addressed the Engineers Club, in San Francisco, on Aug. 10, while on his way to Los Angeles.

Emmet D. Boyle, manager for the Mason Valley Mines Co. in Nevada, has returned to Mason Valley from an examination trip in the Mother Lode district, in California.

F. H. Brownell, first vice-president of the American Smelting & Refining Co., is visiting various plants of the company in the West. He will also spend some time at the Federal Mine, in the Coeur d'Alene district.

A. E. Brugger sailed from New York on Aug. 15 on the *Paris* en route to the Belgian Congo, where he will assume the technical direction of the operation of the Forminière Group of diamond-mining companies in the Kafai field.

Arthur W. Burgren, who has been assistant superintendent at Dolores Mines of the American Smelting & Refining Co. at Matehuala, S. L. P., Mexico, has been transferred to the San Pedro mines as superintendent. His address is Apartado No. 132, San Luis Potosi, S. L. P., Mexico.

William J. Loring has returned to Los Angeles from a three-weeks' inspection trip in the Harshaw mining district of Arizona. He is making Los Angeles his present business headquarters. Mr. Loring expects soon to visit New York.

Joseph Myers, managing director of the Bingo gold mine of Herb Lake, Man., on his return from Winnipeg to The Pas was tendered a banquet on Aug. 5 by about 100 of the mining men, merchants, and other citizens, William Burt, president of the Board of Trade, occupying the chair.



Arthur W. Jenks

Arthur W. Jenks, of Berkeley, Calif., is engaged in a series of examinations of mining properties in the Northwest, in the interest of Eastern capital.

George Drysdale, auditor for the Phelps Dodge Corporation, with headquarters in Douglas, Ariz., has been appointed assistant comptroller of the corporation, vice **John MacNair**, who resigned to become treasurer of the Old Dominion company. Mr. Drysdale will continue to make his headquarters in Douglas.

Sir Newton Moore, a director of the British Empire Steel Corporation, representing the British interests in the company, has arrived in Canada and after visiting the steel plant at Sydney, N. S., has gone to Newfoundland to inspect the Wabana iron ore property. It is believed that his visit will have an important bearing upon the policy of the corporation.

C. H. Marvin, president of the University of Arizona, has announced that **T. F. Buehrer**, assistant professor of chemistry, has discovered a new process for analyzing gold solutions, which it is believed is better than those now known. The process, however, will not be made public until the national convention of the American Chemical Society to be held soon in Los Angeles.

Dorsey A. Lyon, the acting director of the U. S. Bureau of Mines, is making an inspection trip to the field stations of the Bureau. He spent Aug. 10 and 11 in Minneapolis, Aug. 13 at the

Columbus station, and Aug. 14 and 15 at Pittsburgh. He also will visit the experiment station at Rolla, Mo. Later he will visit the new field office of the Bureau at Joplin. He expects to be in Denver on Aug. 27, 28, and 29, and will spend the week of Aug. 31 at Salt Lake City.

C. H. Benedict, metallurgist for the Calumet & Hecla Consolidated Mining Co. at Lake Linden, Mich.; **W. H. Schacht**, general manager of the Copper Range company, Painesdale, Mich.; **W. J. Uren**, superintendent of the Seneca Copper Mining Co., Keweenaw County, Mich.; **Dr. C. M. Carson**, acting president of the Michigan College of Mines, Houghton, and **H. T. Mercer**, chief engineer Copper Range company, Painesdale, Mich., attended the annual meeting of the Lake Superior Mining Institute at Ishpeming, Mich., on Aug. 13.

Obituary

A. E. "Ted" Lowe, for many years foreman and superintendent of various companies in the Tonopah, Nev., district, died in San Francisco on Aug. 5, after an illness of more than a year.

George Stahl, one of the best-known mining men in Nevada, formerly joint owner with his brother Frank in the bonanza lease at National, was accidentally killed on his ranch near Golconda, Nev., on July 28.

W. C. Alexander, president of the North American Exploration Co. and the Keystone Development Co., of Salt Lake City, and for many years active in Utah mining, died in Brookline, Mass., on Aug. 3. Burial was at Mr. Alexander's birthplace, Lafayette, Ind.

Martin K. Hennelly, known in mining camps from British Columbia to California, died at his home in Spokane on Aug. 9. He came to the West from Chicago in 1881 and settled in Spokane in 1883, afterward locating at Murray, Idaho, and removing to Spokane in 1889. Mr. Hennelly was seventy years old.

Joseph H. Biggers, for many years active in Utah mining, died in New York Aug. 4 of pneumonia. For the last decade Mr. Biggers had made his home in Salt Lake, although he had plantation interests at Wellsport, British Honduras, Central America. During the last five years, Mr. Biggers had given most of his time to development of the Pittsburg mine, in American Fork Canyon. He is survived by his widow and a son, Joseph H. Biggers, Jr., cashier of the Ely National Bank.

James Breen, of Spokane, Wash., died at Hot Springs, Mont., on Aug. 1. He was interested in many Spokane mining ventures, the majority of which developed to be some of the best-paying properties in the West. He began his active mining career at Butte in the early days. Later, he built the smelter at Northport, Wash., which he operated for many years. He built smelters at Trail, B. C., at the Britannia mine near Vancouver, B. C., and at Crofton. Until ten years ago, he was active in the operation of smelters and mining properties.

Societies, Addresses, and Reports

A.S.P.A. Directors Pleased with Work

Meet at Salt Lake City—Production Totalling 100,000,000 Oz.
Silver in North America Is Represented

By Gail Martin

Special Correspondent

PERHAPS the most significant feature of the board of directors' meeting of the American Silver Producers' Association, held in Salt Lake, on Aug. 10, was the whole-hearted manner with which leading mining and smelting operators of the United States set to work to perfect an organization capable of working vigorously for the best interests of the industry. Both from the standpoint of interest and attendance, officers of the association stated that the meeting was an unqualified success. Attendance was particularly gratifying. Although the full board could not attend, the roll call found present a preponderant number of directors, among whom, as the following list shows, were some of the most important figures in the silver-mining industry:

Prominent Men Present

F. H. Brownell, first vice-president of the American Smelting & Refining Co., New York; C. F. Kelley, president of the Anaconda Copper Mining Co., New York; F. M. Smith, smelter director of the Bunker Hill & Sullivan Mining & Concentrating Co., Idaho; Alfred Harrel, president of the California Rand Silver, Inc., California; Henry M. Rives, secretary-treasurer of the American Silver Producers' Association and secretary of the Nevada Mine Operators' Association, Reno, Nevada; Robert E. Tally, general manager of the United Verde Copper Co., Jerome, Ariz.; E. J. Raddatz, president and general manager of the Tintic Standard Mining Co., Salt Lake; W. Mont Ferry, managing director of the Silver King Coalition Mines Co., and president of the American Silver Producers' Association, Salt Lake; L. O. Evans, counsel for the Anaconda Copper Mining Co., New York; and James F. McCarthy, president of the Hecla Mining Co., Wallace, Idaho.

One of the most important topics considered was the reintroduction of the Pittman silver act for the repurchase of 14,500,000 oz. from domestic producers. Assurances from leading Senators and Representatives were unanimous that this bill, passed in the Senate and lost in the House during the closing days of last session, would become a law at the next session if presented. Advisors of the association contend that the mandatory provisions of the Pittman act of 1918 having been violated to the extent of 14,500,000 oz. it devolves upon Congress to pass the Pittman act of last session to make good the deficiency.

W. Mont Ferry, president, stressed the fact that payment for this amount of silver at \$1 an ounce would not come from the United States Treas-

ury; it would not add to the burden of the taxpayer; it was not a subsidy. The money to finance the purchase, in event the bill passes, would come from England, which already has paid for the silver sold by the United States during the war. Silver men contend that the sum of \$14,500,000 in English money now reposes in the United States Treasury as a fund held in trust for producers of the metal.

During the course of the sessions directors expressed the opinion that great benefits have already accrued to the industry from having a silver producers' organization. The excellent presentation of the miner's case before the revenue department in the silver-mine revaluation hearing resulted from operators possessing an organization capable of working for the best interests of the industry.

Response to the call for membership has been excellent, according to the report of the membership committee. Already the organization represents a total annual production of 100,000,000 oz., or nearly 60 per cent of the world's production. Domestic producers, almost without an exception, have responded to the invitation to join. Foreign producers like the Nipissing, the Cerro de Pasco, and others, as well as domestic companies marketing silver as a by-product, have signified their willingness to co-operate with the association.

E. P. Earle, president of the Nipissing Mines Co., Ltd., of Ontario, Canada, has become a director of the association. Business prevented Mr. Earle from attending the Salt Lake conference.

Other matters acted upon by the directors were:

Authorization of a joint advertising campaign with the National Fabricators of Silver to popularize the metal.

Provision for adequate representation of the association at the hearing of the House ways and means committee at Washington, D. C., Oct. 10, when proposals concerning drastic changes concerning the taxation of mines will be considered with reference to the revision of the present revenue bill.

Resolutions commending the Bureau of Mines for its co-operation with the association with reference to certain problems on which important progress has been made.

Election of E. V. Daveier, general manager of Butte & Superior Mining Co., to the directorate to fill the vacancy caused by the resignation of Charles Bocking, who has gone to British Columbia as manager of the Granby Consolidated Copper Co.

Election of Robert E. Tally to the office of first vice-president to fill the vacancy.

Lake Superior Mining Institute Meets at Ishpeming

The twenty-fourth annual meeting of the Lake Superior Mining Institute took place on the Marquette iron range and the American and Canadian Soos, Aug. 13 and 14. More than 100 members and guests took the entire trip.

Following is a list of papers that were prepared in advance for the meeting and which were distributed at Ishpeming.

"Use of Explosives"—J. R. St. Clair.
"Discussion of Paper by C. M. Lake"—Carl Zapffe.

"Moffat Tunnel Progress"—Douglas C. Corner.

"Present Scraping Practice at the Cliffs Shaft Mine"—Lucien Eaton.

"The Marquette Iron Ore Range"—Geo. A. Newett.

"The future of the Lake Superior District"—M. C. Lake.

"Stratigraphy and Correlation of the Cuyuna Iron Ore District, Minnesota"—Carl Zapffe.

"Calumet & Hecla Reclamation Plant"—C. H. Benedict.

"Marquette City Water Power Plants"—Harlow A. Clark.

"The Principles of Mine Fan Installation"—Clyde W. Nicolson.

"Measurement of Geological Time By Atomic Disintegration"—Alfred C. Lane.

The following officers were elected at the meeting: President, E. W. Hopkins, Ironwood, Mich.; vice-presidents, J. H. Hearing, Duluth, Minn.; S. R. Elliott, Ishpeming, Mich.; A. D. Chisholm, Ironwood, Mich.; managers, C. H. Benedict, Lake Linden, Mich.; R. S. Archibald, Negaunee, Mich.; treasurer, J. E. Nelson, Negaunee, Mich.; secretary, A. J. Yungbluth, Ishpeming, Mich.

It was decided to hold the next annual meeting on the Gogebic iron range in Michigan, although no dates were set.

First Announcement of Power Show in November

The Fourth National Exposition of Power and Mechanical Engineering will be held in the Grand Central Palace, New York, from Nov. 30 through Dec. 5, 1925.

The Power Show, as this exhibition is styled, is an important clearing house of information for the executives and engineers of all industries. In this it is different from the exhibitions devoted to the equipment of a single industry, as power is a fundamental factor in every industry and a showing of the machines and apparatus required for its economical generation and use gives an opportunity to every industrial executive to discover some means of cutting his production costs.

As usual, the annual meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers will be held during the week of the exposition and their programs have been planned to allow opportunity for a through inspection of the exhibits.

The managers of the exposition are Fred W. Payne and Charles F. Roth with offices in the Grand Central Palace, New York City.

Utah Engineers Primed to Entertain Institute Visitors

Will Show the Best Features of Leading Silver Producing State—
Important Technical Program

ALL PLANS have been made by the Utah section of the American Institute of Mining and Metallurgical Engineers and by leading Utah operators for the entertainment of delegates to the summer meeting of the Institute, to be held in Salt Lake City, from Aug. 31 to Sept. 4. Headed by L. S. Cates, general manager and vice-president of the Utah Copper Co., the general committee has arranged a program that will give the visitors a comprehensive idea of the Utah mining and smelting industries.

One of the main features of the Institute will be trips to famous Utah mining camps, Bingham, Tintic, Park City, to the new steel plant at Ironton, to Great Salt Lake and other historic and scenic points of interest. Special entertainment is being planned for the visiting ladies by the ladies' auxiliary of the Utah section.

Technical Sessions Each Evening

In the main, technical sessions will be held in the evening at the Hotel Utah, convention headquarters. This schedule will leave the days open for trips to outside points.

Registration will begin at 8:30 Monday morning, Aug. 31. At 9:30, Governor George H. Dern will welcome delegates at the opening session of the Institute on the mezzanine floor of the Hotel Utah. The first technical session will be called at 10:30, at which L. S. Cates, manager of the Utah Copper Co., will preside.

At 12 noon there will be a special organ recital for the visitors at the Tabernacle in the Temple grounds, adjoining the Hotel Utah. At 2 p.m. an excursion will be run to Saltair, the Great Salt Lake resort, where members will have the opportunity of taking a swim. Golfers will also be given a chance to play at the Salt Lake Country Club. At 2:30 there will be a meeting of the board of directors of the Institute.

At 8 p.m. the technical session will be presided over by Chairman James W. Wade, assistant general manager of the Tintic Standard Mining Co. The metallurgical session will be presided over by A. B. Young, assistant manager of the International Smelting Company. The same evening a reception will be held for the ladies in the president suite at the Hotel Utah.

All of Tuesday will be taken up by a trip via special train to Bingham, Magna and Arthur to inspect the plants of the Utah Copper Co. and the Garfield smelter of the American Smelting & Refining Co. A special luncheon will be provided for the ladies who do not make this trip.

At 7 p.m. the mining and geology section discussion will open. G. W. Crane, consulting geologist of Salt Lake, will preside. At 9 o'clock the same evening, there will be a reception at the home of Governor and Mrs. Dern.

The remainder of the stay in Salt Lake will be taken up by trips to various points of interest. On Wednesday, visitors will have their choice of a trip to the Murray and Midvale lead smelters or a trip to the Ironton smelter of the Columbia Steel. At 8 o'clock in the evening a formal dinner will be tendered visitors by Utah engineers and operators at the Hotel Utah. On Thursday, delegates will be given their choice of three interesting trips: Eureka, Park City, or Tooele. At Eureka the mines and milling plants of the Chief Consolidated and the Tintic Standard Mining Co. will be visited. At Park City, the Silver King Coalition, the Park Utah, the Ontario, the Park City Mining and Smelting Co.'s properties, and the Keystone are to be inspected. The Tooele trip will include a visit to the International smelter.

In the evening, beginning at 8 p.m. members will be entertained at the Hotel Utah by moving pictures and musical numbers. Friday will be left open for special trips which members may wish to take before leaving for Yellowstone Park or the parks of Southern Utah.

Institution of Mining and Metallurgy Reproves H. F. Marriott

A communication from the Council of the Institution of Mining and Metallurgy, of London, says:

"Statements referring to the Institution of Mining and Metallurgy contained in a recently published book entitled 'Money and Mines,' by Hugh Frederick Marriott, have been brought to the notice of the council. Mr. Marriott, as stated on the title page of the book, is a past president of the Institution, and he is still an ex-officio member of the council. The following is a quotation from page 96 of the book:

"The usefulness of the Institution of Mining and Metallurgy would be much greater if it included within its purview character as well as competency. It possesses a power of expelling members guilty of unprofessional conduct, but this power is rarely exercised. The question that has really to be faced and decided is whether the Institution exists to maintain and improve the status of the mining profession as a whole, performing the same services for its members as the Law Society does for solicitors and the General Medical Council for doctors, or whether it exists to promote and protect the selfish interests of its members like a trade union."

"The council take grave exception to the words quoted above, which Mr. Marriott has been requested, by resolution unanimously adopted at a largely attended special meeting of the council, to withdraw without qualification.

"The statements quoted and the inferences to be drawn from them are in entire disaccord with the practice

and procedure of the council, with which Mr. Marriott is fully conversant.

"Having regard to his stated position, the council, in order to avoid any possible misapprehension, desire it to be known that they have not been in any way, directly or indirectly, associated in the preparation of Mr. Marriott's book."

International Mine Rescue Contest at Springfield, Sept. 10

The Fourth International First Aid and Mine Rescue Contest will be held at Springfield, Ill., Sept. 10, 11, and 12, under the auspices of the U. S. Bureau of Mines.

The International First Aid and Mine Rescue Contests, open to all miners, quarrymen, and workers in metallurgical plants and in the petroleum and natural gas industries, are held annually under the auspices of the Bureau, with the co-operation of the American National Red Cross, the National Safety Council, and various mine operators' associations and miners' organizations. Contests for international championships in first aid and mine rescue methods are conducted, and various cups, medals, and prizes are awarded to the winners. The Congressional medal, given annually to the team of miners adjudged to be most thoroughly skilled in first aid and mine rescue practice, will also be awarded.

Another interesting feature of the contest will be the bestowal of the medals offered annually by the Joseph A. Holmes Safety Association in commemoration of notable deeds of heroism performed by miners in succoring their comrades in time of peril or disaster.

American Chemical Society Hears Discussion of "Matter"

The seventieth meeting of the American Chemical Society was held at Los Angeles, from Aug. 3 to Aug. 8, 1925. At the general open meeting held at the Biltmore Hotel on Aug. 3, Dr. Alexander Findlay, of the University of Aberdeen, Scotland, gave an address on "The Twilight Zone of Matter," and Dr. W. R. Whitney, of the General Electric Co., Schenectady, N. Y., talked on "Matter—Is There Anything in It?"

Montana Section Smokes

The Montana section of the A.I.M.E. held an informal smoker at the Silver Bow Club, Monday evening, Aug. 17. The Institute meeting in Salt Lake was discussed and attendance urged. Alex M. McDonald is secretary of the Montana section.

A. E. S. Will Meet at Chattanooga

The annual fall meeting of the American Electrochemical Society will be held this year at Chattanooga, Tenn., on Sept. 24-26. A number of important papers will be presented by well-known authorities on electrochemical subjects. This meeting will follow closely completion of the Wilson Dam at Muscle Shoals and the society will take the opportunity to make an inspection trip to this point as part of the program.

Recent Technical Publications

Reviews, Abstracts, and References

SOUTH AFRICA is to have a new magazine to interpret industrial developments in the vast region from Cape Town to the Congo and from Angola to Mozambique. It is to be called *The Mining and Industrial Magazine of Southern Africa*, and is to be published every two weeks, beginning Sept. 9, the publication offices being at 46 Anderson St., Johannesburg. Owen Letcher, well known to American mining men as editor of the *South African Mining and Engineering Journal*, is to be the editor of the new journal, and it is his aim not only to have a paper that will interest both technical men and lay readers in Africa, but that will be particularly valuable to investors and technical men in Europe and America. Naturally, the development of the copper and platinum fields to the north will be followed closely. The subscription price abroad has been established at 17s. 6d.

Mineral Resources

International Control of Minerals. Published jointly by the American Institute of Mining and Metallurgical Engineers and the Mining and Metallurgical Society of America, New York. Pp. 171. Sold by the Mining and Metallurgical Society, 2 Rector St., New York, and by the American Institute of Mining and Metallurgical Engineers, 29 W. 39th St., New York. Price 50c., postpaid 55c.

These are the joint reports of the committees and sub-committees on Foreign and Domestic Mining Policy of the Mining and Metallurgical Society and of the committee on Industrial Preparedness of the A. I. M. E. There are separate reports by the sub-committees on antimony, chrome, graphite, manganese, mercury, petroleum, platinum metals, quicksilver, tin, tungsten, and vanadium. These minerals, students of the problem will at once recognize, are the "War Minerals"—that is minerals for the supply of which the United States depends mainly upon importation from foreign countries. Petroleum has been included in the group on account of its strategic importance, and because the future domestic supply is considered a debatable question.

Taking it altogether, these reports present the most reliable account of the situation of each of the described metals in the United States and the relation of the United States reserves and industry to those of the rest of the world. The title "International Control of Minerals" is somewhat of a misnomer for this collection of papers, for the idea of international control is hardly hinted at in the volume, and is far from being the subject of it. Moreover the point of view of the papers is American, not international.

Students of the supply of metals, whether impelled by an industrial interest or instigated by the important economic and political issues entailed, should not fail to have this truly authoritative summary. J. S. SPURR.

Alberta Geology—The Alberta Geological Survey has recently published a bulletin on the "Geology of the Foothills Belt Between McLeod and Athabasca Rivers, Alberta," by Ralph L. Rutherford. The district contains coal deposits. Copies are obtainable from the Department of Geology, University of Alberta, Edmonton, Alberta.

Mine Timber—Bulletin 235, just issued by the U. S. Bureau of Mines, is destined to have wide distribution, for it is an up-to-date book on a subject of interest to many. The title is "Mine Timber, Its Selection, Storage, Treatment, and Use," by R. R. Hornor and Harry E. Tuft, with a chapter on "Methods of Prolonging the Life of Mine Timber," by George M. Hunt. (118 pp.; price 30c. from the Superintendent of Documents, Washington, D. C.) Timber has become so scarce and expensive in the vicinities of most metal mines that the data here given on materials for mine supports, timber supply and consumption, salvaging, causes of destruction, protection against fire, insects, and decay and similar subjects will be read with considerably more interest than would have been the case twenty or thirty years ago. Proprietary articles used for preserving mine and other timbers are not discussed quite as completely as might be desired, no mention being made of Wolman salts, for example, described in *Mining Journal-Press* last year, though the general characteristics of the essential components of these salts are mentioned. The book is well illustrated, with both photographs and drawings, and contains several informative tables.

Iron and Steel Statistics—The annual statistical report of the American Iron and Steel Institute for 1924 is now available from the offices of the institute, 40 Rector St., New York City. (102 pp.) The book contains the usual wealth of statistical data regarding the industry it covers.

Australian Mining and Metallurgy—The *Bulletin* of the Institution of Mining and Metallurgy for July contains a lengthy paper prepared for the Empire Mining and Metallurgical Congress last year—"An Outline of Mining and Metallurgical Practice in Australia." Part 1 is devoted to coal; Part 2 to iron; Part 3 to gold, with separate treatment of the practice in Western Australia, in New Zealand, and at Mount Morgan; Part 4 to silver, lead, and zinc, discussing Broken Hill, Broken Hill Associated Smelters at Port Pirie, and electrolytic zinc; Part 5 to copper, with special reference to Mount Lyell in Tasmania; and Part 6 to tin in Tasmania, New South Wales, and Queensland. The paper, of 204 pp., is obtainable for 8s. at the offices of the institution, Cleveland House, 225 City Road, London, E. C. 1.

American Mining Congress—The report of the twenty-seventh annual convention of the American Mining Congress, held last fall at Sacramento, has been published from the office of the secretary, Washington, D. C.

Patents

Antimony Production—No. 1,548,854. Aug. 11, 1925. H. M. Schleicher, Boston, assignor to American Metal Co., Ltd., New York. The process of separating metallic antimony from compounds containing it, together with an alkali metal, comprising subjecting the compound to the action of a reducing agent and treating the resultant alloy with water.

Rock Drills—No. 1,547,968. July 28, 1925. A. H. Skaer and O. E. Clark, Denver, assignors to The Denver Rock Drill Mfg. Co., Denver. Means for operating and controlling the air valve on a drill.

No. 1,548,455. Aug. 4, 1925. G. H. Gilman, Claremont, N. H., assignor to Sullivan Machinery Co. Design for a hammer drill.

Sulphur Extraction—No. 1,548,109. Aug. 4, 1925. W. P. Thornton, Rock Ridge, Ill. A method of washing the impurities out of crude sulphur by the use of hot water in a mixing apparatus.

Concentrating Table—No. 1,548,536. Aug. 4, 1925. J. H. Macartney, San Francisco, assignor of one-sixth to C. E. Brinkman, San Francisco. Design for a concentrating table, operated by pneumatic means.

Jig—No. 1,549,128. Aug. 11, 1925. S. H. Boylan, Joplin, Mo. An adjustable discharge trough extending from the grate of a jig, the discharge from which is governed by the weight of ore.

FLOTATION

No. 1,547,548. July 28, 1925. W. F. Allen, Jr., and W. L. Reid, Telluride, Colo. Design for a pneumatic flotation cell with side walls that converge upwardly nearly to the top, above which point they flare out sharply.

No. 1,549,492. Aug. 11, 1925. Max Kraut, Los Angeles. Design for a mechanically agitated flotation cell, with vertical impeller shaft.

No. 1,549,316. Aug. 11, 1925. J. H. James, Pittsburgh, assignor to C. P. Byrnes, Sewickley, Pa. The patent covers the addition of liquid aldehyde fatty acid to the frothing tank.

LEAD AND ZINC ORE TREATMENT

No. 1,548,351. Aug. 4, 1925. L. F. Clark, Jersey City, N. J. Ores containing lead minerals are treated by forming on the mineral particles a superficial film of lead chromate, an organic substance then being used to oxidize the compound formed and to precipitate the oxidation products on the particles.

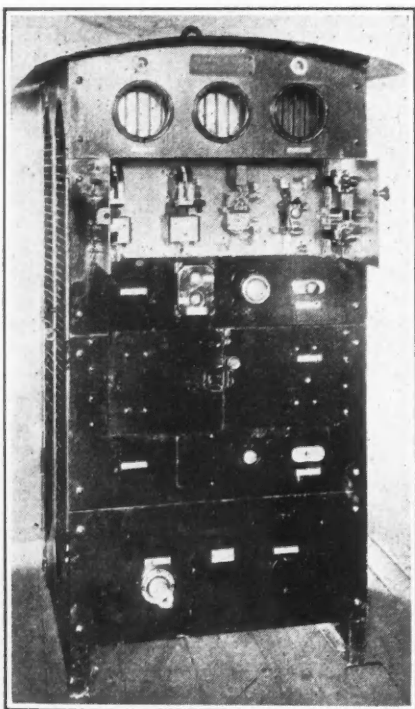
No. 1,549,062. Aug. 11, 1925. N. C. Christensen, Salt Lake City. Ores containing galena are mixed with an acid brine to dissolve the lead as chloride and to drive off the sulphur as hydrogen sulphide. The gas is then treated with lime to form calcium sulphide, which is used to precipitate the lead as sulphide from the brine.

No. 1,549,063. Aug. 11, 1925. N. C. Christensen, Salt Lake City. Ores containing zinc sulphide are mixed with hot concentrated hydrochloric acid to convert the zinc to a chloride. The mixture is then heated to drive off the excess acid, and the zinc chloride formed is dissolved out of the insoluble residue with water to form a zinc chloride solution.

New Machinery and Inventions

Battery-Charging Outfit Made for Rough Usage

A completely self-contained battery-charging outfit is now in operation in one of the large anthracite mines in Pennsylvania. It has been designed to withstand the rough treatment to which underground equipment is often subjected. The equipment was built in the



Self-contained outfit for charging storage batteries of mine locomotives

form of a switchboard panel by the General Electric Co.

The housing framework is made of 2½x½-in. machine steel, welded, with a missile-proof covering on back and sides of ¾-in. expanded metal grille, No. 13 standard gage. The roof is formed of a heavy plate of 0.156 in. stretcher leveled steel, the customary gentle roll for the shedding of water. An extra heavy eyebolt is fastened through the roof to the framework to provide for easy shifting of the equipment, by crane or handles, from one part of the mine to another.

A strong clip on the doors provides protection by the use of a padlock against meddling by unauthorized persons. The meters at the top of the panel are viewed through three port-holes, protected by bars.

The doors of the upper section, opened, expose the relays and contactors. The right-hand door carries a reset handle for the overload relay, thus allowing the operator to reset the relay without unlocking the door.

A handwheel for the dial switch, a push-button station, and a voltmeter switch are all mounted on the solid portion of the panel directly below the swinging doors of the upper middle section.

Track-shifting Machine Entirely Redesigned

Referring to the Peterson patented track shifter, which it was stated in the *Mining Journal-Press* of Aug. 15 is now being made by the Nordberg Manufacturing Co., that company says that the machine has been entirely redesigned and, while the principle is somewhat the same as that of the older machine, the new track shifter embodies changes in almost every detail. It is larger, heavier and stronger, and will shift track more rapidly and over a wider distance. The Nordberg company is the only licensee under the Ernest E. Peterson patents.

New Valve-in-head Soot Blower for Water Tube Boilers

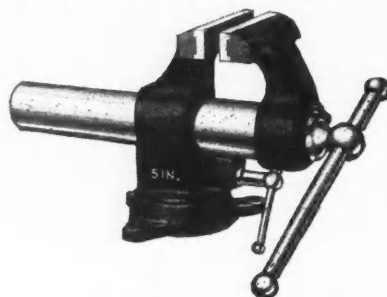
A new soot blower for water tube boilers has recently been introduced by the Marion Machine, Foundry & Supply Co., Marion, Ind. It is known as the Type EB and is similar to the company's former planet soot blower, except for improvements including an independently operated valve-in-head.

The valve and valve seat are in the top flange of the gooseneck. A lever situated on the riser pipe, in convenient reach of the engineer, operates the valve. When ready to blow, a downward pull of the lever at once releases dry steam, cleaning the tubes and driving the soot and fine ash up the stack or into the combustion chamber. An upward thrust of lever immediately closes the valve. There are no worm gears, cams, pilot whistles or useless parts to get out of order and cause trouble and it is claimed the operator can get 100 per cent blowing pressure throughout the entire blowing arc.

A Bench Vise Made of Steel Drop Forgings

A vise made entirely of drop forgings, excepting only the handle, has recently been introduced by the Fulton Drop Forge Co., Canal Fulton, Ohio. Each part is machined to be interchangeable with the same part on any other vise of the same size. The jaw plates are knurled and forged under the hammer and doweled onto the jaw.

The vise is lighter than the old-fashioned cast-iron type. It is made with a swivel base and wedge lock that is quick to set and automatic in tightening up, and has a grip that cannot



A light vise of drop forgings

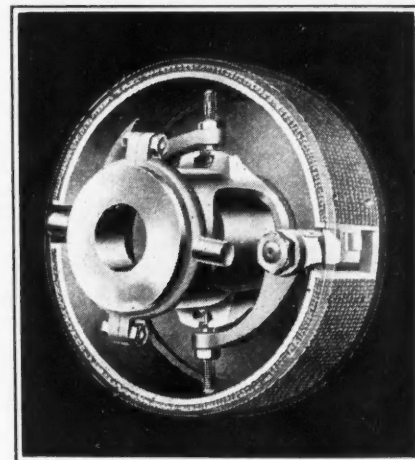
shake or break loose. It is also made in the stationary type.

The vise is made in four sizes: 3 in. with jaws opening 5½ in.; 4 in. with jaws opening 6 in.; 5 in. with jaws opening 8 in.; and 5 in. heavy duty with jaws opening 8 in. The vise is known as the "Dropfo."

A Friction Clutch of Simple Design

Production of a friction clutch and cutoff coupling, known as the Hoerl clutch, has been begun by the Wolf Company, Chambersburg, Pa. In construction the clutch is simple, having only eight parts, namely two rings, two levers, a shell, a cone, a collar, and a plate. It is engaged by the cone sliding along the shaft, causing the levers to force the Raybestos-covered rings against the inside of the shell rim. It can be thrown in gradually or quickly, and gives a clean cut release as soon as the lever is thrown.

When throwing out the clutch the action of the levers and cone pulls the rings away from the shell, assuring a positive release, regardless of speed. By moving a set collar all parts of the clutch are readily accessible. The clutch is said to be particularly applicable in tight locations, where shaft space is valuable.

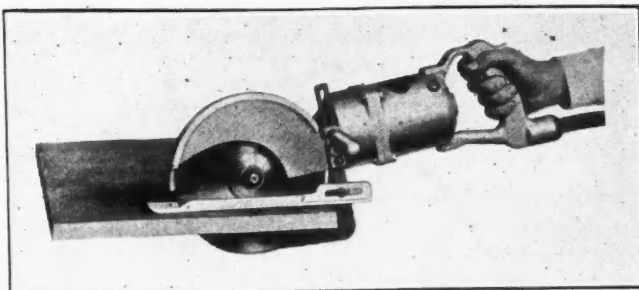


This friction clutch has only eight parts

Portable Electric Circular Saw

For a large number of uses where a circular saw is used at all the new electrically operated portable saw shown in the illustration should enable work to be done faster and with less expense. Various attachments may be used with the device for beveling or other operations beside sawing. A momentary contact trigger switch is used with the machine to insure safety, as the operator's finger must be held on the switch to keep the motor running. A handle on the side aids in holding the saw in a steady position while the cut is being started and an adjustable guide makes possible the maintenance of a predetermined line to be followed in cutting. Power for operating the saw is furnished from any convenient lamp socket. The saw is made by the Michel Electric Hand Saw Co., 166 East Grand Ave., Chicago, Ill. See cut on next page.

Many jobs can be done more quickly with the aid of this portable electric saw. See page 314.

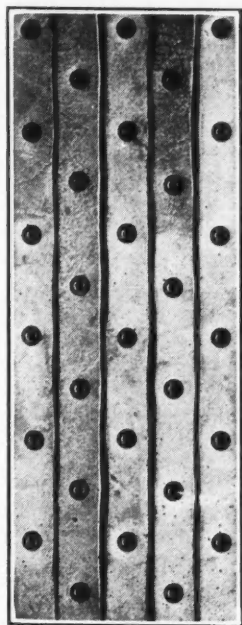


Manufacturing Activities Concentrated

The Haynes Stellite Co., manufacturers of stellite metal cutting tools and other articles of these high-speed, rust, and corrosion resisting alloys, has just completed concentration of the company's activities at its plant at Kokomo, Ind. All service in connection with the company's products will hereafter be extended direct from the plant, it is announced. Headquarters for administration, sales and engineering activities will be at Kokomo, these being conducted under the direction of C. G. Chisholm, general manager.

An Interesting Type of Belting

A belt which is said to have almost the grip of a chain on a cog-wheel through its peculiar construction has been developed by Alexander Brothers, Inc., Philadelphia, Pa. The belting consists of an oak tanned leather backing to the under surface of which are attached narrow longitudinal strips of a chrome leather treated with tallow. These strips are held in position by means of hollow brass rivets which are clinched on the under side of the chrome leather. The depressions surrounding the rivet ends, combined with the blind holes in the rivets, act as suckers during use and increase the very high adhesion of the strips.



This belt is so constructed that it grips a pulley tightly

Trade Catalogs

Stokers.—Detroit underfeed stokers of the single retort type are described in Bulletin 1018, 32 pp., of the Detroit Stoker Co., Detroit, Mich. The bulletin contains a number of fuel-bed cross sections showing conditions of the fire with respect to air distribution and movement toward the dumps.

Another section is devoted to the application of the stoker to both low and high set boilers. Still another section shows how twin settings serve very large boilers.

Grouting and Cement-Gun Work.—The Weber Engineering Corporation, Singer Building, New York, has issued a folder describing its work of excluding undesirable mine water and of repairing and rebuilding mining structures with the use of the Weber Intrusion Method and cement-gun work. Further information is given in its book M 104.

Automatic Dump Car.—Bulletin 140 of the Bloomsburg Locomotive Works, Bloomsburg, Pa., briefly describes the company's products, including larries and automatic dump cars and locomotives of various types.

Soot Blower.—Bulletin 220 of the Marion Machine Foundry & Supply Company, Marion, Ind., describes a new soot blower, the Marion type EB, for water tube boilers.

Snow Motor.—Snow Motors Inc., Detroit, Mich., have issued an illustrated folder describing in detail an Armstead snow motor. This interesting device has been described in detail in previous issues of the *Mining Journal-Press*.

Packing.—The Garlock Packing Co., Elmira, N. Y., has issued a new 40-page catalog describing its metal packings and the service that it gives its customers.

Coal Storage Plant.—Bulletin 84 of the Wellman Seaver-Morgan Co., Cleveland, Ohio, describes the W-S-M safety stop, a device intended for use on the runway rails of coal storage bridges.

Prospecting Drills.—A new addition of its catalog B55 has been issued by Sanderson Cylone Drill Co., Orrville, Ohio. It is entitled "Big Blast Hole Drills." It contains about twenty more pages than the old edition.

Mining and Milling Machinery.—The Traylor Engineering & Manufacturing Co., Allentown, Pa., has issued its general catalog No. 2000, superseding Bulletin 1000. It has 40 pages, pocket size.

Magnetic Separators.—Circular II-26 issued by Thomas Prosser & Son, New York City, American representative of Fried. Krupp Cast-Steel Works, Essen,

Germany, describes a new patent process of recovering fuel from cinders by means of new electromagnetic separators of the patented Ullrich type.

Coal Hoists.—Bulletin 5 issued by Lee & Jardine, Richmond, Va., describes the cinder and coal hoists made by the Chillingworth Engineering Corporation, for whom the former company are general licensees.

Exhaust Fans.—Bulletin 3506, June, 1925, issued by the American Blower Co., Detroit, Mich., contains 26 pages devoted to data and description of the "ABC" steel plate exhaust fans, Type E.

Air Heating.—A new catalog, 18 pp., has been issued by the American Blower Company, Detroit, Mich., describing the Venturafin method of heating.

Pumps.—Bulletin 6A, July, 1925, issued by the Connersville Blower Co., Connersville, Ind., describes the use of the smaller Connersville vacuum pumps for priming large centrifugal pumps by exhausting the air from the centrifugal pump and its suction piping.

Ball Bearings.—"Norma" precision ball bearings of the open and closed types and "Hoffman" precision roller bearings are described in separate 18-page catalogs issued by Norma-Hoffman Bearings Corporation, Stamford, Conn.

Explosives.—A bulletin entitled "Brands of Du Pont Explosives and Uses to Which They Are Adapted" has just been issued by the explosive department of E. I. du Pont de Nemours Co., Wilmington, Del., to aid users in selecting the proper explosives.

Thickener.—The improved vacuum type Genter thickener is described in a new bulletin, No. 1, dated June, 1925, which has been issued by the General Engineering Co., Salt Lake City, Utah. This thickener as used at Trail, B. C., was recently described at length in the *Mining Journal-Press*.

Gas Pumps.—Bulletin 13 C, July, 1925, issued by the Connersville Blower Co., Connersville, Ind., describes the Victor rotary positive gas pumps for exhauster and booster service in small gas plants, oil refineries, and natural gas fields.

Hoists.—Hoists for construction and material handling operations are described in Catalog 31 recently received by the S. Flory Manufacturing Co., Bangor, Pa. Hoists of the steam, electric, gasoline, and belt-driven types are covered.

Recorders.—The Uehling Instrument Co., of Paterson, N. J., has issued a new bulletin, No. 140, covering its line of vacuum recorders which operate on the mercury-column principle, employing no moving parts, springs or diaphragms.

Welding.—A small book of twenty pages entitled "Answers to Questions About the Oxyacetylene Process" has been received from the Air Reduction Sales Company, New York.

Air Heater.—The C-E air heater, intended as a means for returning to the furnace a large part of the heat ordinarily lost in flue gases, is described in Catalog AH-2 issued by the Combustion Engineering Corporation, Broad Street, New York.

The Market Report

Daily Prices of Metals

Aug.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
13	14.50	56.375	57.75@58.00	9.20	9.20	7.50
14	14.40@14.625	56.625	58.25	9.25	9.30	7.575
15	14.40@14.60	56.625	58.25	9.25	9.35	7.60
17	14.45@14.50	56.25	57.75	9.30	9.35	7.60@7.625
18	14.55	56.00	57.625	9.35	9.40	7.625
19	14.55@14.625	55.875	57.50	9.45	9.40	7.625
Av.	14.521	56.292	57.875	9.30	9.333	7.590

*The prices correspond to the following quotations for copper delivered: Aug. 13th, 14.75c.; 14th, 14.65@14.875c.; 15th, 14.65@14.85c.; 17th, 14.70@14.75c.; 18th, 14.80c.; 19th, 14.80@14.875c.

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

Aug.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
13	62 ³ / ₈	63 ³ / ₈	67 ³ / ₄	256 ¹ / ₄	259	37 ¹ / ₁₆	35 ¹³ / ₁₆	36 ⁵ / ₁₆	35 ¹³ / ₁₆
14	62 ³ / ₈	63 ³ / ₈	68	259 ¹ / ₄	261 ³ / ₄	37 ³ / ₈	36 ³ / ₁₆	36 ³ / ₄	36 ³ / ₁₆
17	62 ³ / ₈	63 ³ / ₈	68 ¹ / ₂	257 ¹ / ₄	259 ³ / ₄	37 ⁷ / ₈	36 ³ / ₈	36 ³ / ₄	36 ³ / ₈
18	62 ³ / ₈	63 ³ / ₈	68 ³ / ₄	256 ³ / ₄	259 ¹ / ₄	37 ⁷ / ₈	36 ⁵ / ₁₆	36 ³ / ₄	36 ⁵ / ₁₆
19	62 ³ / ₈	63 ³ / ₈	68 ³ / ₄	256 ⁷ / ₈	259 ¹ / ₂	38 ¹ / ₄	36 ⁵ / ₈	36 ³ / ₄	36 ¹ / ₄

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

Silver, Gold, and Sterling Exchange

Aug.	Sterling Exchange "Checks"	Silver		Gold London	Aug.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
13	4.85 ¹ / ₄	69 ⁷ / ₈	32 ¹ / ₂	84s10 ¹ / ₂ d	17	4.85 ³ / ₈	70 ³ / ₈	32 ⁷ / ₁₆	84s10 ¹ / ₂ d
14	4.85 ³ / ₈	69 ⁷ / ₈	32 ³ / ₁₆	84s10 ¹ / ₂ d	18	4.85 ³ / ₈	70 ³ / ₈	32 ⁷ / ₁₆	84s10 ¹ / ₂ d
15	4.85 ³ / ₈	70 ¹ / ₈	32 ¹ / ₂	....	19	4.85 ¹ / ₄	70 ³ / ₈	32 ¹ / ₄	84s11 ¹ / ₂ d

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

Metal Prices Improve Except for Tin

New York, Aug. 19, 1925.—A fair volume of business with gradually improving prices for copper, lead, and zinc featured the non-ferrous metal markets for the week ending today. Sales of copper were not nearly so large as the preceding week, but after a few days of weakness the price has become firmer. Lead continues to be scarce, with a wide range of prices. Zinc was rather dull, but demand has improved this week. The price in the domestic market is above European parity, and there is little business abroad. Silver on Monday reached 70³/₈c., a high for the current movement.

Copper Fairly Firm at 14⁷/₈c.

Sales of copper in the domestic market during the week were less than half the total for the preceding week. However, this was to be expected in view of the exceptionally large transactions in the first half of August. Producers were holding at 14³/₈c. delivered, but a good tonnage of cheaper metal was offered on Friday, Saturday, and Monday, so that little business was done at the higher figure. London dealers sold in the domestic market, but this metal disappeared by Tuesday, and today 14⁷/₈c. has been realized on a good-sized

tonnage in the Connecticut Valley. However, producers are not pressing metal on the market and are content to wait for their price, which seems well established Wednesday afternoon at 14³/₈c. Figures issued by the American Bureau of Metal Statistics for July show an estimated world production of 129,300 tons, compared to 129,700 in June and 139,600 tons last March, the high month of the year. With production declining and consumption proceeding unabated, a still further decline in refinery stocks is anticipated. These reached a new low at the end of June. The contemplated increase in freight rates on copper from eastern refineries to consumers has been deferred for 120 days, during which time the I.C.C. will hear protests.

A. S. & R. Lead Price Increased to 9.40c., New York

The contract price for lead set by the American Smelting & Refining Co. was increased three times during the week, on Thursday, Aug. 13, from 9c. to 9.15c., on Friday, Aug. 14, to 9.25c., and on Wednesday, Aug. 19, to 9.40c. The situation remains much as it has been for several weeks, except that the spread between the outside market and the quotations of the leading producers is not so wide. Prices in St. Louis and New York in the outside market are about on a parity. Inquiries continue in large volume, although the demand for spot metal is probably less acute. In Europe the price is sufficiently high to prevent Mexican ore lead from coming into the domestic market. In some quarters it is believed that demand will be such in the United States that the price here will be increased to a point sufficient to bring foreign lead into the market. July production of refined and antimonial lead in the United States and Mexico was 1,890 tons less than the corresponding figure for June. However, the average rate thus far in 1925 has exceeded the average for the corresponding period in 1924 by 4,500 tons.

Zinc Market Improves

Strength in the domestic market, particularly by galvanizers, has helped the zinc market, in spite of the absence of any considerable market in Europe. Production in July was the lowest for several months, but this was accounted for by the temporary suspension in the Joplin-Miami district, and the increase in the figures for August is expected to be material. High grade continues to command 8¹/₂c. to 8³/₄c. delivered.

Tin Market Slow

The domestic tin market has been quiet all week with a modest decline in price to 57.50c. for prompt Straits. Forward metal is off from an eighth to a quarter cent from the prompt price.

Silver Makes a New High

The New York silver market advanced sharply on Aug. 15 on the strength of orders for both local and San Francisco delivery, and with the demand continuing over the week-end, a new high quotation for the year in New York was reached on the 17th. London also advanced on the 17th to 32 $\frac{1}{2}$ d. and this rate was maintained on the 18th, although New York declined on that day. Both London and New York declined on the 19th but the market closes steady at the lower level with orders for account of both China and India.

Mexican Dollars: Aug. 13th and 14th, 53 $\frac{1}{2}$ c.; 15th, 54c.; 17th, 54 $\frac{1}{2}$ c.; 18th, 54 $\frac{1}{2}$ c.; 19th, 54c.

Exchanges Remain Steady

The principal foreign exchanges have changed little during the last week. Closing cable quotations on Tuesday, Aug. 18, were as follows: francs 4.67c.; lire 3.60c.; and marks 23.8c. Canadian dollars 0.0396 per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

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

Antimony—Chinese brands, spot, 18@18 $\frac{1}{2}$ c. per lb.; September, 16 $\frac{3}{4}$ @17c. Cookson's "C" grade, spot, 19 $\frac{3}{4}$ @20c. Needle and oxide nominally unchanged from quotations in the Aug. 8 issue.

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

Cadmium—60c. per lb. London, 2s. 3d.

Iridium—\$400 per oz. for 98@99 per cent. Nominal. London, £75.

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

Palladium—\$78@\$83 per oz. Crude, \$65. London, £17 nominal.

Platinum—\$120 per oz. refined officially quoted. Sales also at \$115@\$118. Crude, \$113@\$113.50. London, £25 per oz. for refined; crude £23.

Quicksilver—\$82@\$82.50 per 75-lb. flask. San Francisco wires \$82. London, £13 15s.@£14. Market very dull.

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 Aug. 8 issue.

Metallic Ores

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

Tungsten Ore—Per unit of WO₃, N.Y.: High-grade wolframite, \$12@\$12.50. Ordinary quality, \$11.50 @ \$11.75. Market fairly active for forward ship-

ment on account of unsettled conditions in China.

High-grade Western scheelite, \$12.50.

Chrome, Galena and Pyrite Radio Crystals, Iron Ore, Molybdenum, Tantalum, and Vanadium Ores are unchanged from quotations in the Aug. 8 issue.

Lead Ore Higher—Zinc Blende Offerings Lowered

Joplin, Mo., Aug. 15, 1925

Zinc Blende		Per Ton
High	.....	\$58.70
Premium, basis 60 per cent zinc	.....	\$55.00 @ \$56.00
Prime Western, 60 per cent zinc	.....	\$53.00 @ \$54.00
Fines and slimes, 60 per cent zinc	.....	\$52.00 @ \$50.00
Average settling price, all..	.....	\$53.35

Lead		
High	.....	\$125.30
Basis 80 per cent lead.....	.....	\$130.00
Average settling price, all..	.....	\$115.65

Shipments for the week: Blende, 14,905; lead, 2,253 tons. Value, all ores the week, \$1,055,750.

Offerings for Prime Western zinc were held down to \$53 basis today by buyers, with a few lots sold on \$54 basis that classed high in that grade. Sellers generally declined to accept lower offerings, and at 5 o'clock 9,500 tons of blende was sold, with buyers firm in refusing to advance offerings.

Lead was given another \$10 lift this week, and an additional tonnage was marketed.

With more than 160 mills in operation the zinc output has advanced to an excess of 16,000 tons per week, and if producers continue to add overtime operation as they have during the past month the output may reach a maximum of 17,000 tons by mid-September, but from the safest estimate available a maximum output can be maintained but a short time.

Platteville, Wis., Aug. 15, 1925

Zinc Blende		Per Ton
Blende, basis 60 per cent zinc.....	.....	\$55.50
Lead Ore		
Lead, basis 80 per cent lead.....	.....	\$125

Shipments for the week: Blende, 1,058 tons; lead, 40 tons. Shipments for the year: Blende, 29,803; lead, 1,308 tons. Shipments for the week to separating plants: 1,710 tons blende.

Non-Metallic Minerals

Amblygonite, Andalusite, Asbestos, Barytes, Bauxite, Beryl, Borax, Celestite, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the Aug. 8 issue.

Mineral Products

Arsenious Oxide (White arsenic)—3.75@4c. per lb.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and Zinc Oxide are unchanged from prices in the Aug. 8 issue.

Ferro-Alloys

Ferrotungsten—\$1.125@\$1.15 per lb. contained W.

Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferro-uranium and Ferrovandium are unchanged from the prices in the Aug. 8 issue.

Metal Products

Rolled Copper—Sheets, 22 $\frac{1}{2}$ c.; wire, 16 $\frac{1}{2}$ c. per lb.

Nickel Silver—29 $\frac{1}{2}$ c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal—Sheets, 20 $\frac{1}{2}$ c. per lb.; rods, 17 $\frac{1}{2}$ c.

Lead Sheets unchanged from prices in Aug. 8 issue.

Zinc Sheets—10 $\frac{1}{2}$ c. per lb. f.o.b. works.

Refractories

Chrome Brick, Firebrick, Magnesite Brick, Silica Brick, and Zirkite are unchanged from prices in the Aug. 8 issue.

Steel and Pig Iron Firm—

Coke Higher

Pittsburgh, Aug. 18, 1925

There is a slow upward swing in the volume of steel buying and of production. The former increases more than the latter, as there have to be increasing sales simply to make up for the completion of old orders. As no stocks of consequence have been in buyers' hands for many weeks, production is a measure of consumption. With conditions generally favorable, the reason production does not increase as rapidly as had been expected in some quarters is that it did not get down to a really low point.

Steel ingot production is now somewhat above the rate in July, which seems likely to be the low month of the year, is about 15 per cent under the average rate in the first half of the year, and about 10 per cent above the average rate in the six years since the war up to the present year.

The steel price situation continues to give a good account of itself. Prices on the whole are fully as firm as a week ago or a month ago. There have been no recent declines, but sheets are not advancing as much as was predicted. Recently they stiffened somewhat but at present they are merely holding their slight advance.

Pig Iron—The market is rather inactive as to turnover, but prices continue quite firm and if there is any change it is likely to be an advance. Bessemer, \$19; basic, \$18; foundry, \$18.50, f.o.b. Valley furnaces.

Connellsville Coke—The market has suddenly become active and very strong, advances coming with a rush. There is the double influence of a steel company in Pittsburgh taking some round tonnages and of there being much buying in the East for non-metallurgical purposes, largely on account of the prospective anthracite suspension. Spot furnace coke, formerly \$2.90, has been bought readily at \$3.25, and if \$3.50 has not been paid it is likely it will be very soon. Foundry remains dull at \$3.75@\$4.25.

Company Reports

Ray Consolidated Copper Co.

Copper; Arizona and New Mexico

Report of the Ray Consolidated Copper Co. for the second quarter of 1925 shows net production of copper and comparison with the output for the preceding three months as follows:

1925	Net Pounds Copper Produced	Average Monthly Production
Second quarter.....	34,700,792	11,566,931
First quarter.....	36,242,239	12,080,746

During the quarter a total of 1,454,400 tons of ore, averaging 1.48 per cent copper, was concentrated, as compared with a total of 1,470,200 tons, of an average copper tenor of 1.54 per cent, treated in the first quarter. This is equivalent to a daily average of 15,982 tons in the second quarter and 16,336 tons in the quarter ended March 31.

The average recovery of copper in concentrates was 24.35 lb. per ton of ore treated, corresponding to a mill recovery of 82.42 per cent, as against an average extraction of 25.41 lb. per ton and a recovery of 82.75 per cent in the previous quarter.

The net cost per pound of copper produced during the quarter, after crediting gold and silver and miscellaneous earnings applicable to operations, was 10.97c., compared with a cost of 10.86c. in the first quarter. These costs include all operating and general charges of every kind, except depreciation and reserve for federal taxes.

The financial outcome for the quarter, set out in comparison with the results for the previous quarter, is shown below:

	Second Quarter 1925	First Quarter 1925
Operating profit from copper production.....	\$815,155.71	\$1,127,034.58
Miscellaneous income, including value of precious metals.....	72,040.98	71,353.78
Total.....	\$887,196.69	\$1,198,388.36

The earnings for the second quarter are based on a carrying price of 13.50c. per pound of copper produced, as compared with 14.14c. per pound in the first quarter.

Calumet & Hecla Consolidated Copper Co.

Copper; Michigan

Calumet & Hecla Consolidated Copper Co. reports for quarter ended June 30, 1925, a net loss of \$405,690 after taxes, depreciation, depletion, etc., comparing with net loss of \$71,261 in preceding quarter and net loss of \$104,799 in second quarter of 1924. The net loss for first half of 1925, was \$476,951, comparing with net loss of \$255,304 in first six months of 1924.

Income account for the quarter ended June 30, 1925, and for the corresponding quarter of 1924 follows:

	June, 30, 1925	June 30, 1924
Gross income.....	\$3,722,309	\$2,085,495
Expenses, taxes, depreciation and depletion.....	4,127,999	2,190,294
Net loss.....	\$405,690	\$104,799

New Jersey Zinc Co.

Report of the New Jersey Zinc Co. for the quarter ended June 30, 1925, shows:

Income (including dividends from subsidiary companies) after deductions for expenses, taxes, maintenance, repairs, depreciation, depletion, and contingencies.....	\$1,613,009.34
Deduct:	
Interest on first mortgage bonds.....	40,000.00
Net income.....	\$1,573,009.34
Deduct:	
Dividend 2 per cent payable Aug. 10, 1925.....	981,632.00
Surplus for the quarter.....	\$591,377.34

An extra dividend of 2 per cent payable July 10, 1925, was declared from surplus accumulated in current year.

Hecla Mining Co.

Lead, Silver; Idaho

Report of the Hecla Mining Co. for the second quarter of 1925 shows the following:

Gross income.....	\$934,914.05
Operating expenses.....	\$372,153.40
Taxes accrued.....	54,000.00
Depreciation (estimated).....	40,467.89
Net profit.....	\$468,292.76
Tons mined.....	77,343
Pounds lead produced.....	12,361,720
Average lead price.....	\$8.14
Ounces silver produced.....	345,910
Average silver price.....	\$0.69

Dome Mines, Ltd.

Gold; Ontario

The report of Dome Mines, Ltd., for six months ended June 30, 1925, shows a total income of \$1,045,494 after expenses and taxes, but before depreciation and depletion, comparing with \$1,053,821 in first half of 1924.

Total income for second quarter this year was \$500,828, comparing with \$544,666 in previous quarter and \$548,349 in June quarter of 1924.

Income account for six months ended June 30, 1925, compares as follows:

	1925	1924
Gross.....	\$2,136,966	\$2,126,768
Expenses.....	1,116,157	1,130,004
Federal taxes.....	63,864	56,311
Balance.....	\$956,945	\$940,453
Other income.....	88,549	113,368
Total income before depreciation and depletion.....	\$1,045,494	\$1,053,821

Nevada Consolidated Copper Co.

Copper; Nevada

Report of the Nevada Consolidated Copper Co. for the second quarter of 1925 shows, in comparison with the output for the first three months of 1925, the following:

1925	Net Pounds Copper Produced	Average Monthly Production
Second quarter.....	18,218,132	6,072,711
First quarter.....	17,595,334	5,865,111

During the quarter a total of 909,859 tons dry weight of Nevada Consolidated ore, containing an average of 1.15 per cent copper, was treated at the concentrator, as against 937,112 tons, averaging 1.08 per cent copper, in the preceding quarterly period. In addition to the company ore handled, 4,518 tons of custom ores was milled and 18,447 tons smelted direct.

The average recovery at the concentrator was 92.29 per cent, corresponding to an extraction of 21.25 lb. of copper per ton of ore treated, as compared with 92.61 per cent and 20.08 lb., respectively, in the previous quarter.

The cost per pound of net copper produced, including plant and equipment depreciation and all fixed and general charges, and after crediting gold and silver and miscellaneous earnings, was 10.99c., as compared with 10.89c. for the first quarter.

The financial results for the quarter are shown below in comparison with those for the preceding quarter:

	Second Quarter 1925	First Quarter 1925
Operating profit from copper production.....	\$430,709.77	\$521,279.52
Gold and silver and miscellaneous earnings.....	195,570.30	257,171.16
Nevada Northern Railway Co. dividend.....	75,000.00	75,000.00
Total income.....	\$701,280.07	\$853,450.68
Plant and equipment depreciation.....	167,862.51	167,862.51
Increase in earned surplus.....	\$533,417.56	\$685,588.17

The earnings for the second quarter are computed on the basis of 13.51c. per pound of copper produced, as compared with an average of 14.36c. per pound for the quarter ended March 31.

Buoyant Metal Markets in Germany

By Dr. James Rubinfeld

It remains an unpleasant fact that capital in Germany is very short—even shorter than a couple of months ago. At the time of writing (the beginning of August) call money demands at least 10 per cent, whereas long credits are generally unavailable. It is, therefore, startling that German copper importers can afford to secure the needed commodities from overseas in proportions that are not short of those obtained in "peace times" as the phrase goes here for the years anticipating the Great War. When calculating consignments going to Holland or certain "floating" shipments to England which oftentimes are diverted to Germany, takings of copper by Germans are nowadays between a fifth and a sixth of the world production. Germany receives about a third of the American exports and the interlinking of German interests with non-American producers has become intensified recently.

As to aluminum, German producers are able to face even the giant of the world, the Aluminum Company of America, in European markets. The "snapping up" of bauxite deposits in Eastern Europe by the American concern has only lately been successfully averted by German interests.

When we read that on one hand so big a firm as is the Th. Goldschmidt Aktiengesellschaft at Essen ceases operations of tin refining because of high costs, it is surprising that tin buying abroad is pretty good. On the other hand, the same holds good of some other refineries, even those built during the war, in relation to the metals imported, though the consumption of them is not commensurate with that of copper.

Little Speculation in German Copper

In a German publication I have tried to give an explanation for the increasing copper takings, which are independent of the rising market which usually occasions good buying of those lagging behind. German copper requirements are by no means speculative, but are of a genuine nature, because the deficiency of the army and the navy and of the big railway orders is largely made up for by strong activities of the electrical trades and of the brass manufacturers. As for the latter, they alone are responsible for at least 100,000 metric tons a year of copper consumed. German brass mills are among the most modernly equipped in the world and their capacity is at least double that of pre-war times, and the cable manufacturers have long enjoyed the benefit of home and foreign orders for transmission wire and cable. Everywhere in Germany the worn-out municipal and postal systems are being overhauled; and Germans have succeeded in securing a large part of some huge cable orders. Then, within a very short period radio broadcasting has expanded to a most remarkable degree.

Electrolytic zinc or premium zinc (for instance that of Great Falls) is finding a good outlet here, albeit the statistical data are not of the exactitude which might be wished in this regard.

By the way, matters of statistics must be taken with great caution in Germany, owing to inflation and the Ruhr dislocation, which rearranges itself slowly. According to some statistics, Germany ought to import copper only to the extent of, say, 20,000 tons or so, whereas it is an established fact that at this moment German imports of copper and copper material exceed that. Recently a large parcel of several thousand tons of copper alloys and old material, chiefly of American origin, easily found purchasers, as it is always Germany which is interested in old metals for arbitrage business. Dealers and jobbers are now disposed to secure raw metals from scrap because of the newly established option dealings at the Hamburg and Berlin Metal Exchanges.

As for lead, consumption is normal because of good employment of cable and storage-batteries makers. Corroding lead suffers somewhat from happenings in China owing to the fact that that country is the best customer of the German dye and color industry. Other lines are experiencing the pinch of dear money.

The same may be said of the zinc business, for galvanizers are looking in vain for orders in view of dormant building trades. Then, there exist yet abundant supplies from

Polish Upper Silesia dating from the first half of June, 1925, when big parcels of zinc sheets and raw zinc were transferred at the time when freedom of duties and other facilities were granted by the Treaty at Geneva. Now the economic war between the two neighbors is going on and zinc stocks are clearing away. Old plans to establish large zinc concentrating plants and refineries are taking shape, but until now capital is lacking in Western Upper Silesia. The same, however, is to be said of the Polish side, as indicated by the fact that the big lead and zinc ore producers there, the Giesches Erben, with its vast deposits at Bleycharley and efficient plants on both sides of the frontier, have been compelled to seek financial help with the American concern of Harriman.

Americans Get Interest in German Firms

Tacit participation of American lenders in German firms is rapidly expanding throughout the country, and later years may reveal a revolution of ownership especially in the metal branch. On the other hand, the Mansfeld Copper Co. of Eisleben has had a narrow escape from crushing indebtedness, thanks to the rising copper quotations. This firm intends to remodel its plant in an up-to-date manner and to make electrolytic metal. Of course this can only be a drop in the bucket of all German requirements. Moreover, the problem of producing wirebars in Germany is not yet altogether solved, even, as it would appear, by the Norddeutsche Affinerie at Hamburg, which is being controlled by the Metallbank at Frankfurt-on-the-Main. Another copper and lead ore producer, which has its basis in Southern Africa, the Otavi Mines Co., has also been able to profit by rising metal prices, although its ores are believed to be refined at the Belgian refinery of Hoboken.

A word may be said at last about the two agencies of the Copper Export Association and the Guggenheims at Berlin. To my knowledge it is not true that the Americans are heavily underbidding one another in Europe, but both are marching along the same line generally. However, the American outsiders are making themselves felt at certain junctures, whilst Katanga salesmen are starting business in Germany. But the surface of copper business in Central Europe is now showing more soundness with regard to prices and deliveries, although the lack of credits is somewhat of a handicap to impoverished customers, despite actual good purchases.

Copper Production Decreased in July

The American Bureau of Metal Statistics gives, in short tons, copper production by the principal countries of the world which furnished about 97 per cent of the world's total in 1923 and 1924. In the main, production of blister copper is shown without any attempt to segregate according to countries of origin.

	May, 1925	June, 1925	July, 1925	Jan. to July 1925
United States.....	77,041	76,587	76,356	557,155
Mexico.....	2,323	3,080(c)	3,015	19,432
Canada.....	2,527	2,410	1,649	13,750
Chile and Peru.....	18,504	18,453(c)	19,056	130,759
Japan.....	5,500(a)	6,000(a)	6,000(a)	40,812
Australia.....	1,473	1,989	741	7,812
Europe (b).....	8,700	7,700	9,300	61,100
Belgian Congo.....	8,856	9,418	9,048	57,204
Rhodesia.....	250	210	210	1,526
Total.....	125,174	125,847	125,375	889,550
Estimate for non-reporting countries..	3,900	3,900	3,900	27,600
World's total.....	129,100	129,700	129,300	917,100

(a) Estimated. (b) Incomplete; partly estimated. (c) Revised.

Figures for the monthly copper production by the countries enumerated above follow:

	1923	1924	1925
January.....	102,643	118,781	130,310
February.....	94,925	117,627	122,975
March.....	113,837	122,616	135,359
April.....	107,492	119,176	124,510
May.....	115,660	124,250	125,174
June.....	113,099	122,100	125,847
July.....	112,220	121,717	125,375
August.....	120,114	119,166	.....
September.....	117,994	116,557	.....
October.....	118,103	129,547	.....
November.....	118,962	122,008	.....
December.....	120,603	125,939	.....
Total.....	1,356,196	1,459,484	889,550
Monthly average.....	113,016	121,623	127,078

Mining Stocks—Week Ended August 15, 1925

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Anaconda	New York	43	41	42	Jy. 18, Au. 24, Q 0.75
Arcadian Consol.	Boston	11	11	11	
Ariz. Com'l.	Boston	11	10	11	Jy. 21, Jy. 31 SA 0.50
Calaveras	N. Y. Curb	1	1	1	
Calumet & Arizona	New York	50	49	50	Jn. 15, Jn. 22 Q 0.50
Calumet & Hecla	Boston	15	14	15	Ja. 30, Mh. 4 0.50
Canario Copper	N. Y. Curb	8	7	8	
Cerro de Pasco	New York	53	51	52	Au. 21, Se. 1, Q 1.75
Chile Copper	New York	34	33	33	Sep. 2, Sep. 28, Q 0.62
Chino	New York	24	24	24	Sept., 1920 0.37
Con. Coppermines	N. Y. Curb	2	2	2	
Copper Range	Boston	22	20	20	Ap. 9, My. 4 1.00
Crystal Copper	Boston Curb	*44	*42	*42	
East Butte	Boston	3	3	3	Dec., 1919 0.50
First National	Boston Curb	*16	*16	*16	Feb., 1919 0.15
Franklin	Boston	*85	*80	*80	
Granby Consol.	New York	17	16	17	May, 1919 1.25
Greene-Canaan	New York	14	14	14	Nov., 1920 0.50
Hancock	Boston			*76	
Howe Sound, new, r. t. c.	N. Y. Curb		16	16	April, 1924 0.05
Inspiration Consol.	New York	28	27	27	Jn. 18, Jy. 6, Q 0.50
Iron Cap	Boston Curb	2	1	2	May, 1923 0.15
Isle Royale	Boston	14	12	14	Sept., 1923 0.50
Jerome Verde Dev.	N. Y. Curb	*95	*95	*95	
Kennecott	New York	55	53	54	Jn. 5, Jy. 1, Q 0.75
Lake Copper	Boston	14	14	14	Jn. 1, Jn. 15 Q 0.50
Magma Copper	New York	43	41	42	Jn. 15, Jy. 15, 0.75
Mason Valley	N. Y. Curb	1	1	1	
Mass Consolidated	Boston	*50	*50	*50	Nov., 1917 1.00
Miami Copper	New York	10	9	10	Au. 1 Au. 15 Q 0.25
Mohawk	Boston	32	31	31	Aug. 1, Sept. 2 1.00
Mother Lode Con.	New York	8	7	7	Jn. 12, Jn. 30 0.37
Nevada Consol.	New York	13	13	13	Sept., 1920 0.25
New Cornelia	Boston	20	19	19	Aug. 7, Aug. 24 0.25
North Butte	Boston	1	1	1	Oct., 1918 0.25
Ohio Copper	N. Y. Curb	*76	*74	*73	Nov. 14, Dec. 2 0.05
Old Dominion	Boston	19	18	18	Dec., 1918 1.00
Phelps Dodge	Open Mar.	†112	†107	†107	Jn. 20, Jy. 2 Q 1.00
Quincy	Boston	25	24	24	Mar., 1920 1.00
Ray Consolidated	New York	15	14	14	Dec., 1920 0.25
Ray Hercules	N. Y. Curb			14	
St. Mary's Min. Ld.	Boston	36	36	36	Ap. 20, My. 20, 3.00
Shannon	Boston	*70	*55	*60	Nov., 1917 0.25
Shattuck Arizona	New York	6	6	6	Jan., 1920 0.25
Superior & Boston	Boston	1	1	1	
Tenn. C. & C.	New York	11	10	10	De. 31, Ja. 15, Q 0.25
United Verde Ex.	N. Y. Curb	23	22	23	Jy. 6, Aug. 1 0.50
Utah Copper	New York	100	99	100	Mh. 20, Mh. 31, Q 1.00
Utah Metal & T.	Boston	*55	*43	*50	Dec., 1917 0.30
Victoria	Boston	*25	*25	*25	
Walker Mining	Salt Lake	2.52	2.30	2.30	
NICKEL-COPPER					
Internat. Nickel	New York	31	30	31	March, 1919 0.50
Internat. Nickel pfd.	New York	99	99	99	Jy. 16, Au. 1, Q 1.50
LEAD					
Carnegie Lead & Zinc	Pittsburgh	7	6	6	
Glad-tone M. M. Co.	Spokane	*22	*22	*22	Jy. 1, Jy. 10 0.0
National Lead	New York	154	151	152	Sep. 11, Sep. 30 2.00
National Lead pfd.	New York	118	118	118	Aug. 21, Sep. 15 1.75
St. Joseph Lead	New York	42	40	41	Jn. 9, Jn. 22, 0.50
ZINC					
Am. Z. L. & S.	New York	8	7	7	May, 1920 1.00
Am. Z. L. & S. pfd.	New York	29	27	29	Nov., 1920 1.50
Butte C. & Z.	New York	6	6	6	De. 10, De. 24 0.50
Butte & Superior	New York	11	10	11	Mh. 19, Mh. 31 0.50
Callahan Zn-Ld.	New York	2	2	2	Dec., 1920 0.50
New Jersey Zn	N. Y. Curb	191	191	191	Jn. 20, Jy. 10 Ex. 2.00
United Zinc	N. Y. Curb			*35	
Yellow Pine	Los Angeles	*72	*70	*70	De. 10, De. 15 Q 0.04
GOLD					
Alaska Juneau	New York	1	1	1	
Argonaut	Toronto	*24	*23	*24	
Barry-Hollinger	Toronto	*43	*40	*42	
Carson Hill	Boston			*20	
Consol. W. Dome L.	Toronto	*13	*13	*13	
Cresson Consol. G.	N. Y. Curb	3	3	3	Mh. 31, Ap. 10 Q 0.10
Crown Reserve	Toronto	*16	*15	*15	Jan. 1917 0.05
Dome Mines	New York	14	14	14	Mh. 31, Ap. 20, Q 0.50
Golden Cycle	Colo. Springs			1.48	Dec. 11, 1924 0.03
Hollinger Consol.	Toronto	14.81	14.77	14.77	Jy. 27, Au. 12 0.08
Homestake Mining	New York	46	45	45	Au. 20, Au. 25 M 0.50
Kirkland Lake	Toronto	*43	*41	*42	
Lake Shore	Toronto	6.42	6.27	6.30	Mh. 2, Mh. 16, 0.05
McIntyre-Poreupine	New York	19	19	19	Aug. 1, Sept. 1 0.25
Newray	Toronto	*22	*22	*22	
Night Hawk Pen	Toronto	*20	*20	*20	
Portland	Colo. Springs			*38	Oct., 1920 0.01
Rand Mines	New York			39	Au. 17, Au. 25 1.52
Teek-Hughes	Toronto	1.67	1.66	1.66	
Tom Reed	Los Angeles	*60	*52	*55	Dec., 1919 0.02
Tough-Oakes	Toronto	*33	*31	*33	
United Eastern	N. Y. Curb			*47	July, 1924 0.05
Vipond Cons.	Toronto	1.20	1.20	1.20	
Wright-Hargreaves	Toronto	5.10	5.02	5.07	Jn. 15, Jy. 1 5.00
GOLD AND SILVER					
Black Oak	N. Y. Curb			*81	
Con. Cortez	N. Y. Curb			*7	
Con. Virginia	San Francisco	5	5	5	
Continental Mines	N. Y. Curb			1	
Dolores Esperanza	N. Y. Curb	*55	*50	*50	July, 1923 0.05
Premier Gold	N. Y. Curb	2	2	2	Jn. 18, Jy. 1, 0.08
Tonopah Belmont	N. Y. Curb	*88	*70	*88	Sep. 15, Oct. 1, 0.05
Tonopah Divide	N. Y. Curb			*23	Oct., 1923 0.10
Tonopah Extension	N. Y. Curb	1	1	1	Mh. 11, Ap. 1, Q 0.05
Tonopah Mining	N. Y. Curb	6	4	5	Mh. 31, Ap. 21, 0.07
Unity Gold	N. Y. Curb	*85	*85	*85	
West End Consol.	N. Y. Curb	*50	*50	*50	Mar., 1923 0.05
Yukon Gold	N. Y. Curb			*35	June, 1918 0.02

Stock	Exch.	High	Low	Last	Last Div.	
SILVER						
Alvarado	Boston Curb	†1	†25		Oct. 1920 0.50	
Beaver Consol.	Toronto	*31	*30	*31	May, 1920 0.03	
Castle-Trethewey	Toronto	*92	*91	*92		
Coniagas	Toronto	1.71	1.55	1.65	May, 1924 0.12	
Keeley	Toronto	1.80	1.78	1.79	Au. 31, Se. 15RX 0.12	
Kerr Lake	N. Y. Curb	1	1	1	Ap. 1, Ap. 15, Q 0.12	
La Rose	Toronto	*43	*41	*42	Apr., 1922 0.10	
Lorrain Trout Lake	Toronto	*93	*90	*93	Jy. 2, Jy. 15 0.05	
McKinley-Dar-Sav.	Toronto	*25	*22	*24	Oct., 1920 0.03	
Mining Corp. Can.	Toronto	2.56	2.56	2.56	Jy. 1, Jy. 15 0.12	
Nipissing	N. Y. Curb	4	4	4	Jn. 30, Jy. 20, Q 0.15	
Ontario Silver	New York	6	6	6	Jan., 1919 0.50	
Temiskaming	Toronto	*16	*16	*16	Jan., 1920 0.40	
SILVER-LEAD						
Ahumada	New York	10	10	10	Jn. 15, Jy. 2, Q Ex. 0.25	
Bingham Mines	Boston	31	30	31	Jn. 20, Jn. 30 Q 0.50	
Cardiff M. & M.	Salt Lake	1.60	1.50	1.50	De. 16, No. 18 0.10	
Chief Consol.	Salt Lake			2.90	Ap. 10, Mv. 1, Q 0.10	
Columbus Rexall	Salt Lake	*9	*9	*9	Aug., 1923 0.05	
Erubicon	Boston Curb	2	2	2	Jn. 15, Jy. 2, Q Ex. 0.25	
Federal M. & S.	New York	19	17	19	Fe. 26, Mh. 15 Q 1.75	
Federal M. & S. pfd.	New York	61	57	60	Au. 25, Se. 15, 1.75	
Hecla Mining	N. Y. Curb	16	16	16	Au. 15, Se. 15 Q 0.50	
Iron Blossom Con.	Salt Lake			*39	Oct. 25, 1924 0.01	
Iron King Mining	Salt Lake	*56	*37	*55		
Keystone Mining	Salt Lake	*69	*64	*69	Au. 12, Au. 26 0.07	
Mammoth Mining	Salt Lake	2.70	2.50	2.50	Jy. 1, Jy. 15 Mv. 25 0.10	
Marsh Mines	N. Y. Curb			*4	June, 1921 0.02	
Park City	Salt Lake	5.85	5.85	5.85	Jn. 15, Jy. 1 Q 0.15	
Park Utah	Salt Lake	5.90	5.85	5.85	April, 1924 0.15	
Prince Consol.	Salt Lake	*36	*30	*36		
Silver King Coal	Salt Lake	8.80	7.95	8.80	Jn. 20, Jy. 1, Q 0.25	
Silversmith	Spokane	*19	*18	*19	Jy. 1, Jy. 10 0.01	
Tamarack-Custer	Spokane	*60	*55	*60	Sept., 1924 0.25	
Tintic Standard	Salt Lake	11.50	11.50	11.50	Jn. 24, Jn. 29 Q 0.40	
Utah-Apex	Boston	6	5	6	Jy. 3, Jy. 15, Q 0.35	
Western Utah Copper	N. Y. Curb			*11		
IRON						
Bethlehem Steel	New York	42	41	41	July, 1924 1.25	
Char. Iron	Detroit			*20		
Char. Iron pfd.	Detroit			*85		
Colorado Fuel & Iron	New York	42	39	40	May, 1921 0.75	
Gr. North'n Iron Ore	New York	28	26	27	Ap. 11, Ap. 30 1.00	
Inland Steel	New York	4	4	4	Au. 14, Sep. 1, Q 0.62	
Messabi Iron	N. Y. Curb	1	1	1		
Republic Steel	New York	15	14	14		
Republic I. & S.	New York	49	47	48	May, 1921 1.50	
Republic I. & S. pfd.	New York	91	90	91	Jn. 17, Jy. 1, Q 1.75	
Shoss-Sheffield S. & I.	New York	102	96	99	Jn. 10, Jn. 20 Q 1.50	
U. S. Steel	New York	122	120	122	Jn. 20, Jy. 1, Q 1.75	
U. S. Steel pfd.	New York	124	124	124	Au. 29, Au. 31 Q Ex. 1.75	
Virginia I. C. & C.	New York			31	Aug. 3, Aug. 29 Q 1.75	
Virginia I.C. & C. pfd.	New York			73	Jan., 1924 1.50	
					Jn. 20, Jy. 2, 2.50	
VANADIUM						
Vanadium Corp.	New York	30	29	30	Aug. 1, Aug. 15 0.50	
ASBESTOS						
Asbestos Corp.	Montreal	72	70	71	My. 1, My. 15 Q 1.00	
Asbestos Corp., pfd.	Montreal	101	100	101	Ap. 1, Ap. 15, Q 1.50	
SULPHUR						
Freeport Texas	New York	17	16	16	Nov., 1919 1.00	
Texas Gulf	New York	112	110	112	Jn. 1, Jn. 15, Q 1.75	
DIAMONDS						
De Beers Consol.	New York	24	22	24	Jy. 27, Au. 30 0.97	
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	2	2	2		
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	50	49	49	Aug. 2, Sep. 1, Q 0.25	
Amer. Metal pfd.	New York	115	115	115	Aug. 21, Sep. 1, Q 1.75	
Amer. Sm. & Ref.	New York	108	105	107	Jy. 10, Au. 1, Q 1.50	
Amer. Sm. & Ref. pfd.	New York	110	109	110	Au. 7, Se. 1, Q 1.75	
Consol. M. & S.	Montreal	114	111	114	Jn. 30, Jy. 15 0.75	
Federated Metals	N. Y. Curb	26	25	26		
Newmont Mining	N. Y. Curb	44	44	44		
Southwest Metals	N. Y. Curb			1		
U. S. Sm. R. & M.	New York	39	38	38	Jy. 6, Jy. 15 Q 0.75	
U.S. Sm. R. & M. pfd.	New York	46	46	46	Jy. 6, Jy. 15 Q 0.87	
* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.						
Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto; by courtesy of Arthur E. Moyses & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange and George H. Watson & Co.; Colorado Springs, Colorado Springs Stock Exchange.						
LONDON QUOTATIONS, WEEK ENDED AUG. 8, 1925						
		High	Low	Last	Date	Per Cent
Aramayo Mines (25 frs.)		78/9	76/10	77/6	May 1925	5(c