

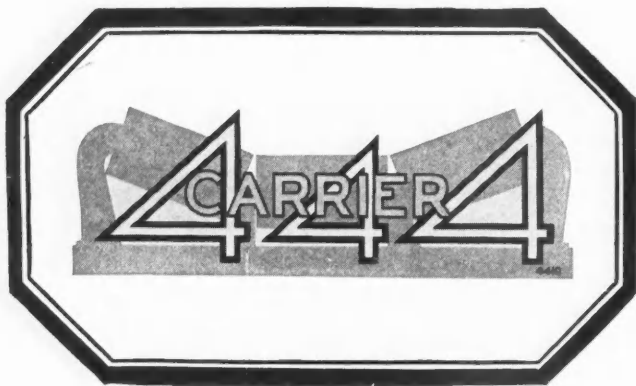
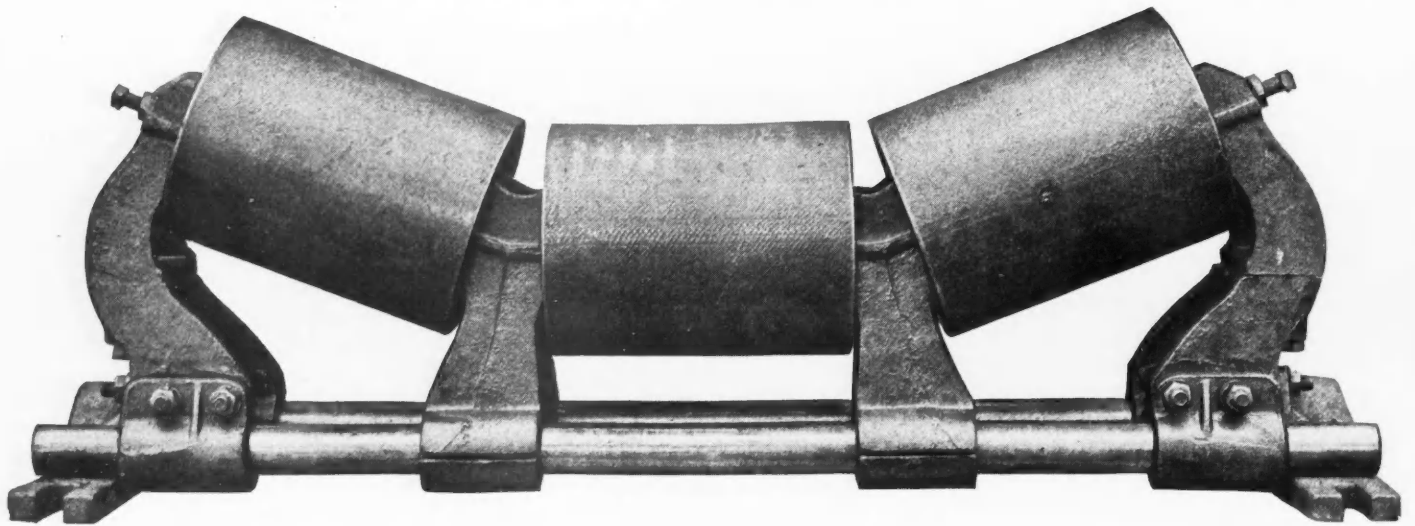
ENGINEERING AND MINING JOURNAL-PRESS

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A steam shovel in action at Jerome, Arizona, on United Verde Copper Company's ground

Metal Mining in Northeastern Washington, by L. O. Howard—Rapid Method of Analyzing Xanthate, by Wilhelm Hirschkind—Mining Mirabilite Near Wabuska, Nev., by John Melhase—Influence of Certain Solids and Gases on the Chloridization Roast, by Aaron B. Bagdasarian



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ENGINEERING AND MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 119

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Number 24

The Bureau of Mines Transfer

TAKING OVER of the Bureau of Mines from the Interior Department to the Department of Commerce seems to be practically an established fact, according to news advices from Washington, printed elsewhere in our columns. This is an important change in the executive administration of the bureaus which represent the mining industry in Washington. It appears, moreover, evidently not a step which will consolidate or strengthen the federal representation of the mining industries. It is a move in the opposite direction from all plans hitherto proposed by the industry, or by Congress, or by the Mining Congress, or by *Mining Journal-Press*, or by the societies of mining engineers, or by any other spokesmen and students of the mining industries. The plans of these students have worked toward a closer organization, ranging from the modest one of having a single executive officer who should administer both the Bureau of Mines and the Geological Survey, with a title perhaps of Assistant Secretary, to the more ambitious and hardly expected hope of a Department of Mines.

The present move is largely on the personal judgment of Secretary Hoover. Mr. Hoover has not made public his argument why the Bureau of Mines should be transferred to his department and why things will be better when this is done. A published statement of his position would have been received with great interest; and very likely Mr. Hoover might have sold his idea to the mining industries. The attitude of the mining industries at present is in general that they are shy of the federal government, and if it will not pester them they will not intrude upon it. The general run of casual comment, however, is to the effect that Mr. Hoover is taking over the Bureau of Mines because he happens to be a mining engineer and when he ceases to be Secretary of Commerce the situation will be worse than ever.

The separation of the two bureaus which deal with mining—the Bureau of Mines and the Geological Survey—into two different departments appears to be, in so far, contrary to effective organization; and to be an example of the scattered administration in Washington which Mr. Hoover has complained about more bitterly than anyone.

We have already presented this opinion in our editorials on this subject in the issue of Jan. 26 and Feb. 16, 1924, and May 9, 1925.

American Institute's New Secretary

THE American Institute of Mining and Metallurgical Engineers, in selecting Dr. H. Foster Bain as its new secretary, has acted with discrimination and judgment. Dr. Bain has a keen and balanced personality, is diplomatic, experienced and popular. He is a ready and pertinent speaker, and is familiar with the problems of the mining industry from

the necessary broad perspective. Dr. Bain has had a long and creditable record, including the position of state geologist of Illinois, geologist of the United States Geological Survey, mine manager, consulting geologist and mining engineer, editor of *Mining and Scientific Press*, and director of the Bureau of Mines. Members of the Institute should co-operate with Dr. Bain in the utmost in his endeavor to shape the course of the Institute along progressive and helpful lines.

Give Industry a Chance

TOO MUCH SIGNIFICANCE should not be attached to disputes arising between mining companies and the state government officials in Mexico. Nevertheless, the recent episodes at Guanajuato and Santa Rosalia seem to be symptomatic of a growing tendency on the part of the local governments to launch policies and adopt measures that more careful deliberation proves to be untenable or unwise.

At Santa Rosalia employees of the Boleo company, third largest copper producer in Mexico, made sundry demands, including an increase in wages and various changes in living and working conditions. The Boleo management offered some concessions, which were declined. Governing officials of Lower California, it is reported, gave encouragement and support to the employees; the men struck and all operations were suspended. Representatives of the company went at once to Mexico City to confer with the federal authorities. The Secretary of Commerce and Industry, acting as an intermediary, was able to compose the differences, and the men went back to work after a month of idleness. Reports state that the workers were suffering seriously for lack of food, as the only supplies were in the company's stores.

At Guanajuato, the Guanajuato Reduction & Mines Co., which employs several thousand men, posted formal notices that it would suspend all operations on May 18. This was in compliance with a law prohibiting a company from shutting down without giving prescribed notice in advance. The reason assigned was inability to operate profitably on account of the "low grade of the ores." It was an open secret, however, that the real reason was the imposition of laws that the company considered burdensome and unreasonable. The local authorities countered by assessing a penalty of 300,000 pesos, for distribution among the workers in the event the plan of shutting down was carried out. On what grounds such a fine could be imposed is difficult to see. Again the federal officials intervened and a commission has been appointed to investigate the entire matter with the hope of reaching some basis on which the company would be willing and able to continue. It would seem that some amendment to the state law would be the only way to attain this end.

It is not necessary to go to Mexico to find instances of state governments passing laws burdensome from industry's standpoint. Minnesota, Arizona, and many

other states nearer home have done that. Though the method may be more plausible, the principle is not different. Exploitation of its natural resources is necessary if any region is to prosper. The state as a matter of policy, should let industry, whether mining or any other, not only live but return a reasonable profit to the shareholders whose money makes exploitation possible.

Patents and Profits

THOSE with experience in obtaining metallurgical patents know how rare it is for one who has conceived an idea of value to derive any benefit from it. Generally he gets nothing but a heartache, as an engineer recently remarked. In few cases does it bring him anything but disappointment and financial loss. Whether he gets the patent or not in the first place very likely depends on the skill of the attorney he has selected, and after he has secured it, he often finds that all he has obtained is the right to defend it in court against infringers. Here the longest purse is apt to win, though occasionally there are surprises. It was this condition that led a well-known metallurgist some time ago to advise young mining students not to think of patenting ideas unless they were able and ready to develop them commercially.

The recent organizing of the Cycle Company to market a thickener that has been developed at the Golden Cycle plant in Colorado Springs is an effort to insure that those who have done the sowing shall also do the reaping. The interests of all concerned are said to be amply safeguarded. The company—a stock company—includes the men who have contributed their work and ideas during the last five years. A. E. Carlton, president of the Golden Cycle company, the Cresson Gold Mining Co. and other enterprises, heads the new organization. The latter company owns the patents, so that whatever profits there may be will come to those who have conceived and worked out the idea. Their success will stimulate the efforts of others along similar lines.

Geological Meaning of Replacement

POPULAR FALLACIES exist among geologists, as elsewhere. One of these is that "replacement" phenomena prove that the replacing agent was "water," or, as they love to say, "hydrothermal," which means "hot water," and, being Greek, settles it. It is therefore assumed that evidence of replacement precludes the assumption that the replacing fluid was a highly concentrated dense solution; and therefore it precludes the conception of an ore-magma, which is by definition a highly concentrated magmatic solution as contrasted to meteoric waters or hot spring waters. But ore-magmas, as defined and described, do in many cases effect replacement, and on a large scale; while sometimes they form fissure veins, which again may be due to replacement, or to injection, the last-named habit corresponding partly to that of igneous rock and hence having been called "veindike."

The pegmatite magma has the same range of habits as the ore-magma (indeed the ore-magma is best conceived of as simply a phase of the pegmatite magmas). Pegmatite magmas effect replacement, and on a large scale. This fact is well known and has been well known for many years; it simply needs being recalled. Also

pegmatite has in many cases the habit of intrusion, and accordingly forms veindikes. Both the consistency of the magma and the nature of the wall rocks, together with other factors, determine, for the pegmatite and for the ore-magmas, the habit of invasion, whether by replacement or by intrusion.

The rock magmas indeed exhibit replacement, and on a variable scale, which in some cases becomes very large. This replacement is internal and external—earlier formed crystals are replaced by the still fluid magma, and engulfed blocks of wall rock are gradually replaced. Thus a granite may replace included blocks of diorite, or of schist; and examples of this are too well known to need anything but a reminder.

None of the magmas are dry melts; they are indeed far from it. They are solutions which always contain important admixtures of water and other gases. But even dry melts have the property of replacement. This has been brought out in a timely article by T. C. Plemister in the April-May number of the *Journal of Geology*, as a result of the investigations of the microscopic relations of sulphide melts with the silica in linings of blast furnaces and converters. Mr. Plemister concludes: "Melts that presumably are nearly or quite anhydrous are capable of effecting replacement. The form of this replacement may be veindike or of a corrosive nature. In the former case, where the veins have eaten their way into the silica, they tend to develop a rounded, bulbous outline. Further, the sulphides tend to form globular replacements within the silica, these globular masses being connected by small replacement veinlets to the larger sulphide masses."

Progress in Mining Engineering

IN PROMOTING increased efficiency in the production of metals, which efficiency has made possible the present average relatively low price of metals, metallurgical advance has been the chief factor, advance in mining engineering has been of importance; and advance in geological knowledge and the application of it has been a strong factor. Increased knowledge of marketing principles has been also of great practical value.

Mining engineering proper has, however, its easily discernible limitations to advance, as the conditions governing it are relatively simple, compared with those that govern the other sciences of the mining industries. The greatest single achievement in mining engineering, as far as cost reduction is concerned, has been the development of open-pit mining, in the iron, copper, bauxite, and other industries, and in continued improvement of these methods; also in the devising of caving methods for large-scale stoping. In smaller operations, with the increased cost of timbering, methods designed to cut out this expense largely or entirely have come into vogue, such as shrinkage and timberless rill stoping. The filling may be derived from the walls of the orebodies, or from development workings; mill tailings may be piped in as filling, as practiced at the Champion mine in the Michigan copper district. Timber rot, a great item of expense, has been controlled by wood preservatives, coating with cement; and in some cases the use of cement, rock, or metal supports has displaced timbering entirely.

More scientific breaking of ore has also developed, due in part to its better standardization and efficiency of

powder; in part to the study of the mining engineer on how to place and drill and load; and also his recognition of the different effects of blasting in different rocks.

Progress in mucking or loading has been made in many important particulars, ranging from the development of better and more scientifically designed hand shovels to the various types of mechanical loaders, improvement on which is even now in progress. This progress in loading extends to the loading at the shaft station, through efficient ore pockets and improved skips, often operated automatically. This goes over into the field of transportation, and the old-style trammer, swearing at an ill-designed and overloaded small car which had jumped the tracks, is rare. Better designed cars, better tracks, and electric motors have improved haulage.

As important as anything else has been the growing comprehension that the efficiency of the labor unit (especially since labor comes higher than before) depends upon how the workman feels. This is divisible into two factors—the influence which governs his feeling when he reports for work, and those which influence him while on the job. Mine managers have attacked both branches of the problem with success. Among the helps to the first-named condition is, as most mine managers affirm, prohibition, together with clubhouses, permanent homes, and indeed higher wages; in the latter category come improved ventilation, safety devices and rules, and human understanding.

Perquisites Versus Salary

PATERNALISM is recognized as something to be avoided in dealing with employees. Most men ask only adequate compensation, a decent place to work and to live, hours that permit some leisure, and a square deal in the matter of advancement. If a plant be isolated, facilities for recreation, education and medical care are undoubtedly appreciated. Efforts to make a camp a desirable place to live in are never wasted, as the decreased labor turnover will show. But there is a limit, a variable one, beyond which such things may be unappreciated and possibly resented. To know where the limit lies a manager must look within himself, to his knowledge of human nature. Anything that appears to make the pay check smaller is sure to be unpopular.

Sometimes the manager or superintendent, while studying problems of this sort involving those beneath him, has a private grievance of his own. Usually he enjoys certain perquisites and privileges, the most commodious house in camp, rent free most likely, a motor car, domestic help perhaps, free ice, free coal and what not—all these having a certain cash equivalent. If his salary, too, is generous and commensurate with his work, these privileges are so much velvet and therefore much appreciated. But more than once it happens that they are in lieu of salary and that the monthly or yearly stipend is a very modest thing indeed. What is the result? Living is comfortable enough, perhaps, his local prestige pleasing, but he finds it difficult to save or make investments because of lack of funds. Such money as he has is needed to educate his children, and if advancing years overtake him still in the same position, he may find it difficult to retire, just as previously he has found it impossible to quit.

The Canadian Asbestos Merger

FOR A LONG TIME, as is well known, the asbestos interests of Quebec have been planning a combination, working together with the New York banking house of Dillon, Read & Co. Quebec has one of the world's largest asbestos provinces, and until recently produced 85 per cent of the world's consumption; virtually, of course, from its proximity to New York, supplying nearly all of the requirements of the United States. Both Canadian and American capital are interested in the mining of the asbestos and in the manufacture and sale of asbestos products, which is in some instances closely tied up to the actual mining enterprises. The principal competition has been South Africa, which from its assortment of mineral wonders, has produced extensive deposits of asbestos. Within the last few years South African competition has become increasingly formidable, until the South African long fibers have been able largely to outsell and compete severely with the Quebec mineral even in the New York market. Canadian operators lay the condition to the lack of co-ordination, mutual helpfulness and intelligence that has characterized asbestos mining in Quebec, which has resulted in high costs and has eventually put the Canadian producer practically out of the market. The French Canadian labor and its priest control have been contributing factors.

The reserves of asbestos are immense, and evidently here is a case of an industry that should cut out ruinous and wasteful methods and take its proper place in the world's business. To this end plans for co-ordinate action have been made, and have proceeded slowly. Admittedly, the organization that is now announced is a trust, which will control North American asbestos; but it has been proved that without co-ordinated methods there would not survive any asbestos industry. There is no analogue to the Sherman anti-trust law in Canada. As the product of the organization is to be marketed in the United States, the promoters have had some fear lest the Sherman law might in some way be considered to apply; but apparently this apprehension has been removed. Possibly the recent decision of the Supreme Court of the United States to the effect that trade associations may compile and circulate data as to cost price and markets may have had a heartening influence on the deal.

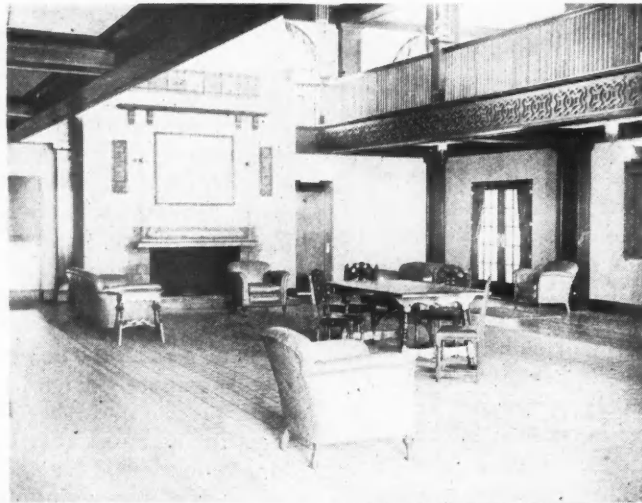
The Canadian organization will then, indeed, have competition in the American market, but this competition will be principally that of the South African asbestos. Arizona produces asbestos and doubtless will continue to compete. It is likely that one of the results of the co-ordinated effort will be a better grading of the Canadian product, making it more desirable and standard, rather than a cutting of prices. Furthermore, a readjustment of prices may be expected. Probably the long-fibered or crude asbestos will have its price adjusted in conformity with Rhodesian competition. The deficit, if any, resulting will likely be made up by raising the price of the shorter fibers and lower grade stocks in which Rhodesian competition is not feared.

This merger is an example of the general tendency to combine for greater efficiency and lower costs. It will have some analogy to the Aluminum Company of America, which has a monopoly of the great aluminum industry of the United States, and even exerts a dominant power in the aluminum industries of the world.

Utah Copper Co.'s New Clubhouse at Garfield



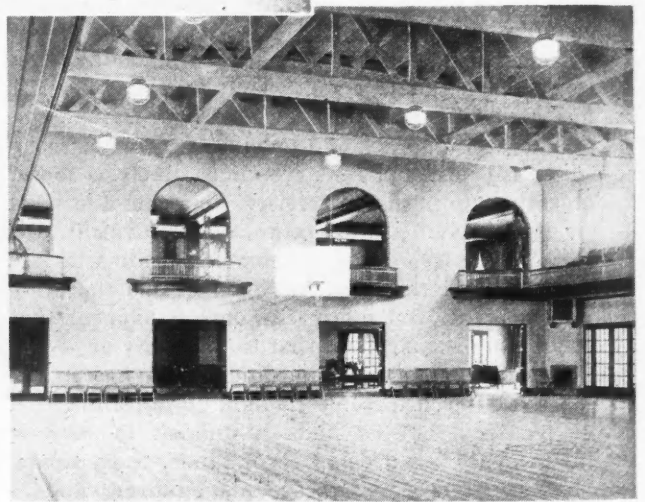
Above. Exterior view of what is perhaps the most beautiful and luxurious employees' club in the West. It is situated at the company's Arthur plant, overlooking Great Salt Lake.



Left. Main floor lounge. Bronze tablets carrying the names of the company's men who served in the World War are given a conspicuous place.



A corner of the mezzanine above the lounge. It serves as a reading, writing and music room



The gymnasium and ball room, 60 by 90 ft. The balconies will accommodate 750 spectators

Metal Mining in Northeastern Washington

*A Survey of the Situation in the Camps of Ferry, Stevens,
and Pend Oreille Counties*

By **L. O. Howard**

Dean, School of Mines and Geology, State College of Washington,
Pullman, Wash.

DURING THE PAST THREE YEARS the production of gold, silver, copper, lead, and zinc has steadily increased in the State of Washington, following the post-war slump of 1921. It is likely that the production of these metals in 1924 will prove to have exceeded that of any previous year except the war years of 1916, 1917, and 1918.

The first production of gold is credited to the year 1850, since when there has been won to the end of 1923 \$28,785,523.¹ Silver also is among the metals mined prior to 1866. The total now is 8,397,278 fine ounces. The first recorded production of lead was in 1898, when 857,555 lb. was marketed. Since that date there has been produced 44,861,159 lb. In 1899, the mining of copper ores began and 17,945,662 lb. has been sold to the smelters. Zinc was first produced in 1911. Since then 8,321,210 lb. has come from mines of eastern Washington. The accompanying graphs, Figs. 1 and 2, which appeared in Bulletin 30 of the Division of Geology and were kindly loaned me by Dr. Shedd, supervisor, show the productive history in more detail. Of the total value of \$42,102,767, more than \$11,000,000 has been produced in the last decade. While this is not a large production compared with that of many states, it represents but the beginning of a mining industry that in time will probably reach a much higher output.

Most of this production has come from three counties in northeastern Washington, north of Spokane, as indicated in Table I. (See Map, Fig. 3.) Of these Ferry and Stevens counties have each produced about 40 per cent of the state's wealth in metals, and at the present time give promise of greatly increased output.

Table I—Production of Gold, Silver, Copper, and Lead in Northeastern Washington

| County | 1909-1919 | 1920-1922 | 1909-1922 |
|------------------------|--------------|-------------|--------------|
| Ferry..... | \$6,410,235 | \$383,614 | \$6,793,849 |
| Pend Oreille..... | 302,739 | 638 | 303,377 |
| Stevens..... | 5,017,751 | 1,224,176 | 6,241,927 |
| Totals..... | \$11,730,725 | \$1,608,428 | \$13,339,153 |
| State..... | \$12,974,398 | \$2,114,053 | \$15,088,451 |
| Per cent of state..... | 90.4 | 76.0 | 84.4 |

During the past summer I visited all of the operating mines in these two counties, in addition to a few prospects where important development was being undertaken. Table II gives the status of these mines as observed in July and August. It will be noted that eight of the thirteen mines are in the ranks of shippers.

Most of the area lies between Clark's Fork, locally known as Pend Oreille River, on the east, and the San Poil River on the west. The mountain ranges have a general north-south trend. West of Clark's Fork is the Calispell Range, extending through the eastern half of Stevens County. Calispell Peak, the highest in the range, has an elevation of 6,905 ft.

East of the Columbia is another range, rising at

¹"Mineral Resources of Washington, With Statistics for 1922," by Solon Shedd, Washington Department of Conservation and Development, Division of Geology, Bulletin 30.

Table II—Active Mines in Stevens and Ferry Counties, Washington

| Stevens County | | | |
|--------------------------------|------------------------|------------------|---|
| Mine | Number of Men Employed | Ore | Output |
| Black Rock..... | 6 | Zinc..... | Developing. Shipped 960 tons of 50 per cent ore, Nov., 1923, to April, 1924 |
| Gladstone..... | 22 | Silver-lead.... | Shipped 2,640 tons yielding \$68,612.71 January to July |
| United Silver } Copper..... | 27 | Copper-silver.. | Milling 50 tons daily, shipped 14 cars January to July |
| Cleveland..... | 6 | Silver-lead.... | 30-ton mill, one shift. 1 ton concentrate daily. Had been 3 tons |
| Daisy..... | 9 | Silver-lead.... | Tuning up 50-ton mill |
| Admiral..... | 7 | Silver-copper.. | Developing |
| Chloride Queen.. | 7 | Silver-lead.... | Developing and planning 40-ton mill |
| Old Dominion.. | 18 | Silver-lead-zinc | Ships occasionally as funds needed. 150 tons of \$100 ore in ten days in August |
| Deer Trail..... | 8 | Silver-lead.... | Construction. Two men mining and sorting ore |
| 110 | | | |
| Ferry County | | | |
| Quilp..... | 20 | Gold..... | 500 tons per month, \$6,000 to \$8,000 |
| Knob Hill..... | 25 | Gold..... | 500 tons per month, \$12,500 |
| Surprise..... | 6 | Gold..... | Shaft sinking and developing |
| Iron Creek..... | 12 | Gold-silver-lead | 1 ton daily 60-70 oz. silver concentrates |
| 63 | | | |

points to about 6,000 ft. Between these ranges in a broad level valley flows the Colville River to its confluence with the Columbia near the boundary of British Columbia. West of the Columbia is another uplift cut deeply by the San Poil River, which rises in Curlew Lake, near Republic, 25 miles south of the international boundary, and empties into the Columbia south of Keller, through a valley whose size is much larger than the present stream. The valley of Clark's Fork is wide in the southern portion, but to the north is flanked by steep walls rising 1,000 ft. above the river. In the central part the Columbia River is broad, but to the north and to the southwest the walls are abrupt. There are many glacial lakes in the region. In general, the mines are at an elevation of 4,000 to 6,000 ft.

A good auto road follows the Colville River, and poorer roads the Columbia, San Poil, and Clark's Fork. The Colville and Columbia are connected by graveled east-west roads at three points. Another road connects

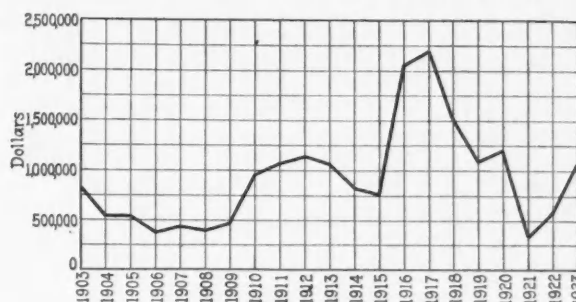


Fig. 1—Curve showing combined values of gold, silver, copper, lead, and zinc produced in Washington, 1903 to 1923

Reproduced from Bull. 30, Division of Geology, Washington Department of Conservation and Development.

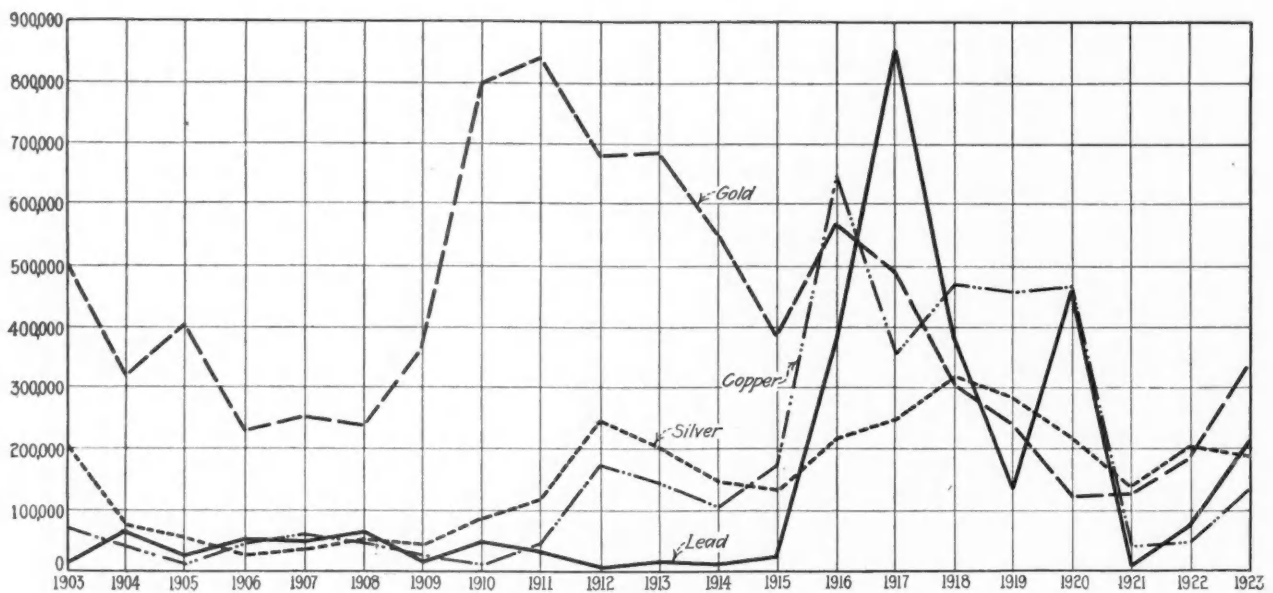


Fig. 2—Curve showing values, separately, of gold, silver, lead, and copper produced in Washington, 1903 to 1923

Reproduced from Bull. 30, Division of Geology, Washington Department of Conservation and Development.

the Colville River and Clark's Fork from Colville to Ione in the north central portion, and another follows Clark's Fork from Newport to the international boundary. Good roads connect all the valleys to Spokane on the south.

A branch of the Great Northern Railway from Spokane to British Columbia points and Oroville in the Okanogan Valley, with branches to Northport and Republic, serves the Colville Valley, and another branch via Newport serves the northern part of Clark's Fork Valley. There is no railroad on the San Poil or the Columbia except for a short distance south of Northport. Unfortunately many of the mines are at a considerable distance from the railroads. Only one district, that of Republic, has railroad spurs at the collars of the shafts. In Table III I have gathered miscellaneous data affecting the transportation facilities. It will

Table III—Transportation in Northeastern Washington

| Mine | Haul to R.R., Miles | Cost per Ton | Smelter | Freight to Smelter |
|-------------------------|---------------------|--------------|---------------------|--------------------|
| Black Rock | 6 | \$2.00 | Mineral Point, Wis. | \$13.00 |
| Gladstone | 14 | 5.00 | Trail | 2.56 |
| Quilp | 0 | 0.00 | Trail | 2.86 |
| Knob Hill | 0 | 0.00 | Trail | 6.50 |
| United Copper | 5½ | 2.00 | Tacoma | 3.50 |
| Cleveland | 19 | 4.00 | Bunker Hill | 3.50 |
| Daisy | 23 | 5.00 | Bunker Hill | 4.75 |
| Chloride Queen | 14½ | 4.00 | Bunker Hill | 5.50 |
| Old Dominion | 7½ | 3.00 | Bunker Hill | 3.50 |
| Deer Trail | 26 | 8.00 | Tacoma | 4.68 |
| Bead Lake | 8 | 3.00 | Bunker Hill | 5.00 |
| Addison Copper | 30 | 10.00 | Bunker Hill | 5.00 |
| Iron Creek | 35½ | 12.50 | Bunker Hill | 4.50 |
| Average except Republic | 17-18 | \$4- \$5.00 | | \$4.50 |

be noted that with the exception of the Republic camp the average haul is 17 to 18 miles, the average cost \$4 to \$5 a ton, and the average freight to smelters about \$4.50. Many of the mines need ore running \$50 a ton before they can consider shipping. Most of the mines do not have bonanza orebodies, nor are there large masses of low grade. Many of the ores are complex. Concentration is an important item. Some of the mines ship crude ore.

In Table IV I have assembled the principal data regarding power. Details of the use of this power will

Table IV—Power Used at Northeastern Washington Mines

| Mine | Power | Pump, Hp. | Hoist, Hp. | Com-pressor, Hp. | Mill, Hp. | Total, Hp. | Remarks |
|----------------|-------------|-----------|------------|------------------|--------------------------|------------|---------|
| Black Rock | Electric | 20 | 20 | 50 | 43 | 133 | |
| Gladstone | Distillate | | 25 | 75 | | 100 | |
| Quilp | Steam | 11 | | | | 100 | Down |
| Surprise | Oil | | | | | 280 | |
| Knob Hill | Distillate | | 50 | 125 | | 175 | |
| United Silver | Electric | | | 250 | 400 | 650 | |
| Cleveland | Oil and gas | 3 | 8 | 100 | (Included in Compressor) | 111 | |
| Daisy | Steam | | | 35 | 40 | 75 | |
| Chloride Queen | Steam | | | 50 | | 50 | |
| Old Dominion | Electric | | | 100 | | 100 | |
| Deer Trail | Steam | | | | | 110 | Down |
| Bead Lake | Electric | | | 150 | 180 | 330 | Down |
| Addison | Steam | | | 40 | | 40 | Down |
| Venus | Steam | | | 50 | 30 | 80 | |
| | | | | | | 2,234 | |

be found in the description of the individual mines. Of the fourteen mines listed, three use gasoline, generating 286 hp., two use fuel oil, generating 380 hp., five use steam for 355 hp., and four use 1,213 hp. in electrical units. The coincidence of good transportation facilities, electric power, and large size of plants is noteworthy.

There are six mills with a total capacity of 650 tons. One is a 150-ton plant, another 100 tons, and four are about 50 tons. Cost of power is variable and will be given when known in the descriptions that follow.

WATER SOMETIMES SCARCE

Water is nowhere overabundant. In the mountains west of Colville Valley are short streams flowing not more than 20 miles to the Columbia. Mines in this range are usually near the top of the divide, and by conservation of water usually have enough at all seasons for small mills. Republic is frequently short of water and during the past dry season the shortage became serious. One day during my stay in the camp there was not even drinking water for part of the day. In the Northport district some of the mines, the Gladstone for example, must haul all water up the mountain in tanks. At Keller the San Poil River furnishes ample water. The Chewelah district is also favored with a plentiful supply.

The proximity of the Coeur d'Alene mining district of Idaho tends to keep wages up, but at the same time enables operators to obtain experienced labor. In many of the camps living conditions are excellent with well-built cottages in pleasant surroundings in timbered country of scenic beauty. The usual small scale of operations has meant freedom from labor troubles.

Most of the districts have abundant mine timber on the properties or near by and in only one or two mines are heavy timbers needed. The whole area is dotted with lumber camps and sawmills. Other supplies are easily obtained by auto trucks traveling over fair roads, but frequently having long hauls. No particular difficulties are experienced in the winter months.

Lead mining is naturally stimulated by the present prices. The copper miner is usually blessed with high silver ores and the zinc mined has been so pure as to command a ready market at good prices. With lower costs and excellent transportation facilities the gold mines at Republic are able to make a reasonable profit, but there are other problems peculiar to that camp which hamper operations there greatly.

SMELTER RATES

Smelter rates cannot be said to be particularly unfavorable, but are often a serious factor when taken in connection with the complex nature of many of the primary sulphide ores, some of which are mixtures of copper, lead, zinc, arsenic, and silver minerals.

Lead ores are usually sold on a schedule calling for payment for 95 per cent of the gold at \$20 per ounce, if over 0.05 oz., and 95 per cent of the silver content at the *Engineering and Mining Journal-Press* quotations for the week preceding date of settlement. Ninety per cent of the lead content is paid for, after deducting 1 1/4 per cent from the wet assay, at the New York quotation of the same magazine for the week preceding settlement date. One hundred per cent of the dry assay for copper (wet less 1 per cent) is paid for at the *Mining Journal-Press* quotations for the preceding week, less 8c. per pound. The treatment charge is \$13 per ton on a 50 per cent base, with 10c. per ton increase for each per cent of lead above 50 per cent and 10c. per ton decrease for each per cent under 50. High silver ores are usually charged up to 3c. an ounce refining charge. There is the usual sulphur charge on ores containing less than 20 per cent lead, of 25c. per unit above 4 per cent up to a maximum of \$2. Zinc is free of penalty up to 5 per cent, with a 30c. per unit charge above that content. Arsenic and antimony are penalized \$1 per unit. Moisture is charged at 20c. a unit if over 6 per cent up to a maximum of \$2. The minimum moisture charge on flotation concentrate is \$1 per ton. There is no penalty for silica or bonus for iron.

Gold ores are sold on a fairly favorable schedule. Ninety-five per cent of the gold and silver are paid for, gold at \$20 and silver at the New York quotation, date of arrival at smelter. Treatment charges are from \$2 to \$4 per ton, depending on the grade of the ore. Silica is penalized 10c. a unit for each unit below 80 and is free above that amount. However, the quantity of this ore that the smelter will accept is limited.

Copper ores are sold on a flat schedule. Silver and gold are paid for at the usual rate. Copper is paid for on a basis of wet assay less 10 per cent, at the New York quotation less 3c. per pound. A flat treatment

charge of \$3.25 a ton is made on ores assaying \$75 a ton.

As elsewhere, the high rate of taxation is one of the bugbears of mining. In Ferry County local burdens have been so heavy that many owners have let their properties go for taxes. Many times when different mines were mentioned and I inquired as to the ownership, the reply was, "That mine belongs to the county." In fact Ferry County is one of the biggest, perhaps the biggest, owner of acreage. The situation here, in which the history of the ownership of property is interesting, is worthy of an article of its own.

At Northport, in Stevens County, there is an excellent example of what the federal income tax can do to a mining property under certain interpretations of the law. The only dividend payer in the district was reduced to insolvency through the demands made by the government under the excess profits and depletion reserve sections of the tax. It is not my wish to take sides in the dispute between the Electric Point Mining Co. and the government. Whichever party is right, no one can deny that tax demands have most thoroughly wrecked this company. The compilation in Table V is taken from the annual reports of the company.

Table V—Production and Cost Record of the Electric Point Mine

| Year | Production | Cost Including Depletion | Depletion | Profit | Loss |
|---------|----------------|--------------------------|--------------|-------------|--------------|
| 1917... | \$562,122.70 | \$481,993.16 | \$243,019.00 | \$80,129.54 | |
| 1918... | 242,538.37 | 272,704.78 | 122,388.60 | | \$25,917.97 |
| 1919... | 66,798.76 | 122,041.25 | 49,661.70 | | 51,931.99 |
| 1920... | 260,489.24 | 288,367.12 | 51,449.70 | | 23,372.86 |
| | \$1,131,949.07 | \$1,165,106.31 | \$466,519.00 | \$80,129.54 | \$101,422.82 |

NOTE—Depletion is at the rate of \$14.90 per ton. For 1917 income and excess profit taxes were estimated at \$13,131.28. The 1917 profit was paid in dividends. The net losses are less miscellaneous income not included in production.

The mine was closed in January, 1921. No more ore was then in sight. The company had followed a policy of holding about \$100,000 as working capital. In September the directors decided to pay \$85,000 in dividends and to use the remainder of the cash surplus, about \$20,000, in seeking more ore. That is, the property was deemed at that time worth the expenditure of \$20,000 in further development and prospecting for ore.



Fig. 3—Map of northeastern Washington, showing location of area described

This dividend brought the total to about 56c. a share on 793,750 shares, or a total of \$364,370.46. In December, 1923, the federal government demanded an additional tax of about \$120,000, this for the year 1917, disallowing the depletion reserve based on the valuation by the company. The opportunity of seeking more ore did not appear to be worth this additional sum. The company is practically insolvent. It will most certainly be many years before this promising property is again developed. Development already done is almost certain to be lost. Thus is a promising mine wholly ruined by the incidence of a tax that would have taken approximately one-third of the profits of the only profitable year the company had, without any regard for the losses of following years. I know of no more illuminating example of the injustices of the income tax as applied to mines.

CAPITAL INSUFFICIENT IN MANY CASES

Perhaps the greatest handicap that the mines in these counties have is the slender capital on which most of them operate. With the exception of the Republic district, in which there are three financially strong companies, all the properties have been developed at a laboriously slow and inefficient rate due to lack of ready funds. All have depended on sales of stock in a weak market and upon ore shipments for development funds. The best results have not always been obtained. Few of them have any outside capital to aid them, and the success being won by some of them is a tribute to untiring effort in the face of many discouraging conditions. Many of them deserve the most intensive development. With one or two exceptions every mine that I visited shows promise of profitable operation.

GEOLOGY AND ORE OCCURRENCE

For a discussion of the general geology of the region the reader is referred to the many excellent publications of the Division of Geology of the State Department of Conservation and Development and the United States Geological Survey.²

Recently some very interesting papers³ have appeared on glaciation in this area, where several unique features are evident, especially in the region to the south.

With the exception of the Republic district, where the ore deposits are unlike anything in the United States, the ores are found principally in metamorphosed Paleozoic sediments, greatly tilted and overlying granitic rocks. Argillites, quartzites, and limestones, greatly shattered locally by igneous activity, are the loci of most of the deposits. Many irregular pods and chimneys of ore have been found in the limestones at the intersections of minute fractures. In other deposits ore is found in definite shoots in well-defined fissures. Nearly all the deposits are near igneous dikes connected with the underlying granite.

²"Geology and Ore Deposits of Republic Mining District," by Joseph B. Umpleby, Washington Geological Survey, Bull. 1, 1910.
³"The Mineral Resources of Stevens County," by Charles E. Weaver, Washington Geological Survey, Bull. 20, 1920.

"The Metal Mines of Washington," by Ernest Patty, Washington Geological Survey, Bull. 23, 1921.

"Lead and Zinc Deposits of Metaline Mining District in Northeastern Washington," by Howland Bancroft, U. S. G. S. Bull. 470, pp. 188-200, 1911.

"The Ore Deposits of Northeastern Washington," by Howland Bancroft, including a section on the Republic Mining District, by Waldemar Lindgren and Howland Bancroft, U. S. G. S. Bull. 550, 1914.

"Geology and Mineral Deposits of the Colville Indian Reservation, Washington," by J. T. Pardee, U. S. G. S. Bull. 677, 1918.

"Glacial Drainage on the Columbia Plateau," J. Harlen Bretz, Bull. Geological Society of America, Vol. 34, pp. 573-608, Sept. 30, 1923.

"The Channeled Scablands of the Columbia Plateau," J. Harlen Bretz, Journal of Geol., Vol. 31, No. 8, Nov.-Dec., 1923.

An unintentional injustice was done this region in 1914, when Bancroft's report⁴ came out. Some of the most important deposits of the earlier days were disseminated replacements in metamorphosed sediments. Speaking of these Bancroft said:

"In the Metaline, Northport and Chewelah districts and in the Old Dominion mine, east of Colville, are deposits of lead and zinc which in general occur as irregular disseminated replacements along shear zones and fracture planes in metamorphosed sedimentary rocks. Along the shear zones in the brecciated country rock, and locally replacing the contiguous strata, are varying amounts of the ore minerals galena and sphalerite, which give way to pyrite below. Associated with the ore minerals in the shear zones and the brecciated country rock are varying amounts of quartz and calcite. The extent of these deposits has not been proved. In general the lead ores, together with some zinc ores, occupy the upper zone, which is not likely to extend more than 100 to 200 ft. below the surface, and it is probable that the lead content will become less and less as the lower limit of this zone is reached. In some deposits the vertical sequence of galena, sphalerite, and pyrite is very regular, galena occurring near the surface, zinc ore gradually becoming more and more abundant, and, at 300 to 500 ft. from the surface, pyrite predominating, with some sphalerite and hardly any galena. Most of the ore shipped from the Last Chance, Old Dominion, and Young America properties was mined near the surface, where cerussite and anglesite are found, as well as the sulphide ores. In the Metaline district smithsonite occurs in the ore and calamine is reported to have been found. Good surface ores are found on many of the properties within the region and in places these extend over large areas. Although developments have not been extensive enough to warrant much speculation on the possibilities of these orebodies, it seems probable that deep exploration will yield chiefly pyrite. The ore deposits of this class are all thought to owe their origin to the after effects of igneous intrusion."

And again⁵ in discussing the Old Dominion mine, a similar prediction was made:

"In the vicinity of the intrusive granite dikes there may be other rich deposits near the surface. Sphalerite will probably increase if deposits lower down are worked, and this in turn will probably give way to pyrite. The future of the mine lies in finding other replacements and mineralized fractures in the limestone near the surface along the strike of the intrusive granite dikes."

Generalization based on meager evidence was never more misleading. At a depth of 790 ft. below the out-

Table VI—Depth of Ore in Northeastern Washington Mines

| Mine | Depth of Ore, Ft. | Depth Developed, Ft. | Remarks |
|----------------------|-------------------|----------------------|-----------------------|
| Black Rock | 200 | 250 | Seeking extension |
| Gladstone | 300 | ... | ... |
| Electric Point | 800 | ... | ... |
| Quilp | 1,000 | ... | ... |
| Surprise | 700 | ... | ... |
| Knob Hill | 570 | 770 | Ore at bottom |
| United Silver Copper | 1,140 | ... | Shoot bottomed |
| Cleveland | 190 | ... | ... |
| Daisy | 400 | ... | ... |
| Chloride Queen | 300 | ... | 800 ft. below outcrop |
| Old Dominion | 565 | ... | 790 ft. below outcrop |
| Deer Trail | 300 | ... | ... |
| Bead Lake | 400 | ... | ... |
| Addison | 150 | ... | ... |
| Iron Creek | 390 | ... | ... |

crop and 565 ft. below the surface the Old Dominion is working as good ore as the mine has ever produced, in a shoot that has been opened at points 200 ft. apart, for widths up to 20 ft. and thicknesses of 40 ft. Recently in shipping ore for funds for further development the company put down a 20-ft. hole and took out of it in as many days ten cars that netted over \$30,000 at the smelter. There are excellent chances here of a big mine, as rich as ever in its history.

⁴U. S. G. S. Bull. 550, p. 26.

⁵Idem., p. 130.

While zinc is prominent, lead is most abundant and silver as high as ever. This might be discussed in a later article on the Old Dominion mine. Fortunately the management has been most competent and was not discouraged by these pessimistic pronouncements and now appears about to reap its reward. Table VI gives the depths to which various mines visited have followed ore, most of them with no signs of diminution or impermanence. Of these the Gladstone, Electric Point, Old Dominion, and Chloride Queen are examples of lead deposits in metamorphosed sediments that might have been expected to be mining only pyrite ere this. Detailed descriptions of these various deposits will appear in connection with descriptions of the various mines to be published in later articles.

MINING METHODS SIMPLE

Simple mining methods characterize the region. Usually a few stulls are sufficient to support the workings, particularly in mines of the Deer Trail, Daisy, Cleveland, Republic, Keller, and Colville deposits. Heavy timbering is needed in the vertical pipes of the Northport district. Open stopes are the rule, although shrinkage stoping was, perhaps mistakenly, used in the United Silver Copper mine at Chewelah. Mining is generally cheap.

All the mines with one or two exceptions are handicapped by too limited development, due to the lack of capital and the need of securing funds from the ore as found, and there is little ore in sight at any time. But confidence in the future is apparently well based in many instances on the record of the past. The occurrence of the ore in narrow bodies facilitates the removal of all developed ore and companies with little working capital dislike to sink additional lifts or drive any development workings that are not demanded by current output. The Knob Hill, at Republic, with strong financial backing, the Old Dominion, at Colville, which provides funds as needed by shipment of high-grade ore from its large reserve, and the Gladstone, at Northport, which has paid its way out of proceeds and developed an impressive number of chimneys ahead of production, are all notable exceptions.

ORE TREATMENT PROBLEMS TO BE SOLVED —MILLS LACKING AT REPUBLIC

Ore treatment problems are pressing in every district with the possible temporary exception of Northport, where the Gladstone ore is all high grade.

Republic is greatly handicapped by the lack of mills. The ore is highly siliceous, hovering around 80 per cent silica, and the smelting market for this material is decidedly limited. During the summer the Trail smelter, the only one buying this ore, would accept only 500 tons a month. Consequently there were but two shippers, either of which might have supplied the whole demand, and others with large amounts of ore of slightly lower grade ceased operations.

Coupled with this hard tough quartz the gold is finely disseminated and partly locked up in selenides and tellurides, requiring exceedingly fine grinding. Cyaniding will extract the gold and silver, as has been proved, but successive mills have failed to grind the ore economically. Experiments are now under way in the laboratories of the School of Mines and Geology of the State College that in the light of modern methods may produce a process that can treat the ore at the mines.

Ore as now shipped from Republic runs \$16 to \$25 in gold and silver. A satisfactory process that would treat \$8 ore would find a large tonnage of such ore available in Republic, and the long-deferred hope of a revival of the early activity of the camp might be realized.

Some of the small mines are equipped with 50-ton mills. While mining engineers generally deplore the erection of mills before a substantial ore reserve is at hand, circumstances sometimes warrant it. Such circumstances exist along the divide between the Colville and Columbia valleys, where the scale of operations and distance from the railroad, freight and treatment rates all work together to demand that ore that does not assay in the neighborhood of \$50 per ton be not shipped. Where finances are low and ore must be shipped to meet the payroll, it becomes expedient to erect small concentrating plants to raise the grade of the ore or to eliminate some of the penalizing elements before shipping to the smelter.

Many mistakes have been made in attempting to erect a sort of standardized mill without competent metallurgical advice. Too often millwrights have posed as metallurgists with disastrous results for the small company. Apparently no attention is paid to the physical characteristics of the ore. The first question asked by the "practical" metallurgist is, "Will it float?" He tests it. It will. A plant is designed consisting perhaps of jaw breaker, rolls and ball mill, often with no classifier or screen (simplicity applied in the wrong place), and all the ore, regardless of the coarseness of crystallization, is ground to flotation size. Result: ball mill not up to rating, sands to flotation, flotation tails to tables and flotation concentrates to the perspiring motor truck for the long haul over the mountains to rail, and the collection of a \$1 moisture penalty at the smelter.

AN IMPROVEMENT IN ORE DRESSING POSSIBLE

A simplification much to be desired is the elimination of flotation as a primary process in the coarsely crystalline lead-silver ores of northeastern Washington, where roll crushing frees at least four-fifths of the gangue from adhering sulphide, and roughing tables following will eliminate it, and relieve the groaning ball mill of its load. Concentrate from such a roughing contains all the metallics that can be saved economically, and if not suitable for smelting, is an excellent material for the ball mill to prepare for successful flotation, at the same time warranting a little more care in the flotation section, where it is always difficult to get labor that understands the idiosyncracies of this temperamental process.

It would seem that as the smeltermen pay principal attention to his slag, so might the millman pay more attention to eliminating tailing and avoiding the fine grinding of much barren quartz. Fads are often expensive. So is flotation wrongly applied, with unskilled operatives and an overloaded ball mill.

In spite of the difficulties of lack of capital, lack of adequate transportation, lack of correctly designed plants, incorrect and illogical geological prognostications, some fine results are being obtained in the mining of the ores of northeastern Washington that justify the belief that some day not too far distant this region is going to "cash in" as a healthy, steady and profitable producer of metallic wealth.

Influence of Certain Solids and Gases on the Chloridization Roast

*Oxygen, Sulphur and Water Beneficial in First Stage of Process but Not in Volatilization—
Silica Always Desirable, and May Be Added to Offset
Harmful Effect of Lime*

By Aaron B. Bagdasarian

School of Mines, University of Idaho



A. B. Bagdasarian

THE chloride-volatilization method of ore treatment has been developed extensively within the last few years and is attracting considerable attention, though it is difficult to foretell its commercial future. At present, it lacks that degree of elasticity which any process must possess to find universal favor. It has many desirable features, however, and every effort directed toward its perfection

made are based on known chemical and metallurgical reactions and on well-established principles.

The data obtained from chloridizing roast practice show that the presence of oxygen is essential for chloridizing an ore if sodium or calcium chloride is used as the chloridizing agent. The reason that the presence of oxygen is necessary in the chloridization is believed to be this: at high temperatures it oxidizes some of the constituents of the chloridization charge, such as sulphur, forming acid radicals which displace the chlorine of the chloridizing agent—that is, set the chlorine free to chlorinate the ore. But in the absence of oxygen, sulphur and silica have hardly any decomposing effects on sodium chloride, as will be shown in further discussion of these substances.

Unfortunately, at high temperatures, oxygen also decomposes the base-metal chlorides. The reaction between oxygen and the chloride of any base metal, M, is reversible as represented in the following equation:



As we are dealing with a reversible reaction, the condition of equilibrium at a given temperature can be represented by the following expression:

$$K_p = \frac{p_{\text{Cl}_2}^2 p_{\text{MO}}}{p_{\text{O}_2} p_{\text{MCl}_2}^2}$$

in which K_p is the equilibrium constant at the given temperature, p the respective partial pressures, and M a divalent base metal. The partial pressures of MO and MCl_2 at a given temperature are, however, constant if the corresponding solid or liquid phases are present. The equilibrium constant, K_p , can therefore be reduced to

$$K' = \frac{p_{\text{Cl}_2}}{p_{\text{O}_2}}$$

From this equation the conclusion is drawn that if the amount of oxygen (the partial pressure of a gas is proportional to its concentration) in the reaction chamber is increased, the amount of chlorine should be increased in the proportion indicated by the equation preceding this paragraph, so as to keep K' constant. Under fixed conditions, however, an increase in the amount of chlorine can be obtained from the decomposition of the metallic chlorides only.

Applying the principle of the law of mass action to this reversible reaction, one can see that, under equilibrium conditions, if the concentration of oxygen is increased, metallic chlorides are converted into corresponding oxides, and, on the other hand, that if the concentration of chlorine is increased the oxides of metals are converted into corresponding chlorides. According to Schulze (1), zinc chloride is readily decomposed by oxygen; for energetic decomposition he suggests the use of potassium chlorate. According to

may prove to be a valuable contribution to modern metallurgy.

The chlorination and the chloridization* processes have many potential advantages over other modes of ore treatment. If their present operating difficulties can be eliminated, they can be utilized for many metallurgical purposes. Low-grade oxidized as well as complex sulphide ores can be treated economically by either one of these processes.

The chemical reactions involved in the chloridizing roast are indeed complex, and are not fully known. Herein lies an obstacle to successful application of the process, for if the details of the major reactions are not understood it will not be possible to make improvements in the present practice. I shall attempt to point out the chemical reactions that some solid and gaseous substances may cause during the period of chloridization. Some of these reactions are important, for under favorable conditions they may greatly influence the actual process of chloridization of an ore.

The problem of chlorinating ores and extracting the metals from the chlorides produced has been the subject of my research work. It is hoped that this paper may suggest to those who are engaged in the metallurgical research on the chloridization or the chlorination processes the necessity of doing exhaustive research also on the chemical and thermodynamical aspects of the problem. The discussions in this paper, with one exception, are not founded on my experiments. The deductions

*Considerable confusion exists in the use of these terms. In this paper the term "chlorination" is used to indicate the process of converting metallic compounds into their respective chlorides by chlorine gas, or by a gaseous compound of chlorine. The term "chloridization" (this more correctly should be termed "chloridation") is used to indicate the ordinary process of chloridization roasting, in which an alkali chloride is used as the chloridizing agent.

The bibliography will be found at the conclusion of this article.

the statement of Duschak and his co-workers (2), the investigations of the Intermountain Station of the Bureau of Mines show that oxygen has a decided tendency to displace chlorine from base-metal chlorides at the temperatures used in chloride volatilization. Experimental data also prove that chlorine gas, at elevated temperatures, attacks oxides of metals and forms the corresponding chlorides or oxychlorides (3).

It follows that the presence of oxygen, although essential in an indirect way to the liberation of chlorine from sodium chloride, is harmful to the actual chloridization of the ore. Excessive concentration of oxygen is sure to prevent satisfactory chloridization, especially if the ore is oxidized and if the concentration of chlorine or hydrochloric acid gas in the reaction chamber is small compared with that of oxygen.

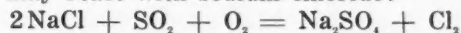
THE EFFECT OF SULPHUR

If the ore to be chloridized has a carbonate gangue and no silica is present, the addition of sulphur may be beneficial, if not necessary. The equation

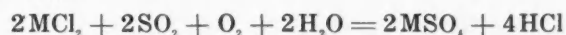


is not a true statement of the reactions involved in the chloridization of a carbonate ore. Most of the base-metal carbonates are decomposed (4) below 300 to 400 deg. C., and the reaction which is postulated above does not take place if the temperature of the roasting furnace is above this decomposition temperature. The decomposition products of carbonates are the respective oxides. Because the oxides of metals are not so readily chlorinated even by chlorine gas, some reducing or deoxidizing agent, such as sulphur or carbon, must be added.

The presence of sulphur in the chloridization charge may be beneficial in two respects: First, by oxidation, sulphur may react with sodium chloride:



By this reaction chlorine is supplied to the system. Second, sulphur may partly or completely unite with the oxygen of the oxidized ore, and thereby render the metals present amenable to satisfactory chloridization. It is true that the oxidized products of sulphur may sulphatize part of the ore, but this tendency is not harmful to chloridization, for the sulphates of metals are more easily chlorinated than the respective oxides. Excessive concentrations of sulphurous and sulphuric fumes are not desirable in a chloridizing atmosphere, for the reason that these may reverse the above-mentioned reaction. In the presence of water vapor and air, sulphur dioxide and metallic chlorides may react as follows:

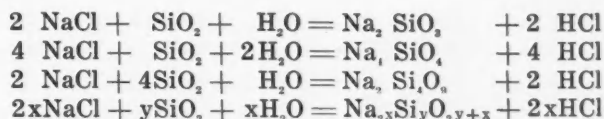


This equation represents the well-known process of Hargreaves, of manufacturing hydrochloric acid from common salt.

It follows that excessive amounts of sulphurous fumes may not only decompose the chloridizing agent, but also the product of chloridization—namely, the base-metal chlorides. The deleterious effect of sulphur in chloridization, first observed by D. A. Lyon and O. C. Ralston (5), can possibly be attributed to this reaction.

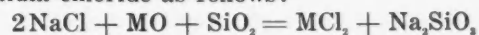
HOW SILICA ENTERS INTO REACTIONS

The interaction between silica and sodium chloride in the presence of water vapor can be represented in a general way by the following equations:



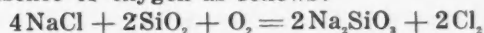
One of the products of these reactions is gaseous hydrochloric acid—a powerful chlorinating agent. If the temperature be high enough, water vapor and silica react on sodium chloride very effectively. This method of decomposing sodium chloride has been suggested as a process of manufacturing hydrochloric acid (6). It is clear that the quantity of silica present in the chloridization charge is an important factor, which has not been fully recognized, although observations derived from practice confirm it (7).

Silica may also act directly with oxides of metals and sodium chloride as follows:



Here, the chloride of the base metal is formed, rather than the silicate, because the chloride is volatile and is carried from the field of reaction as rapidly as formed.

Furthermore, silica and sodium chloride may react in the presence of oxygen as follows:



This reaction may take place within the range of chloride volatilization temperatures, especially if some oxygen carriers, such as copper or iron chlorides, are present as catalyzers. According to A. Gargeu (8) clay which contains about 35 per cent of alumina decomposes approximately 22 per cent of its weight of sodium chloride at about 550 deg. C. The investigations of Lyon, Ralston, Varley and their co-workers (9) also show that oxidized ores having a siliceous gangue can be chloridized without the presence of sulphur.

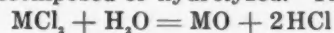
These facts indicate that the reactions described in the foregoing paragraph are important in chloridization roasting. Evidently, under the conditions mentioned, silica or silica-alumina is the only component of the charge which serves as an acid radical to decompose an alkali chloride and form its respective silicate.

It can be concluded that the presence of silica in the chloridization charge is desirable in all respects. This fact should be borne in mind, especially when the material to be chloridized is an oxidized ore whose gangue has a high carbonate content or is deficient in silica.

EFFECT OF WATER VAPOR

Water is almost always present in the ore, and is also brought into the reaction chamber with the air, as moisture, or is produced by the combustion of the fuel, so that its influence is worthy of particular attention.

The combined actions of water vapor and silica, and also those of water vapor and sulphur dioxide, upon salt and base-metal chlorides have already been discussed, and I shall now take up the effect of water vapor alone upon these chlorides. At high temperatures, water vapor has a strong tendency to decompose the chlorides of metals. The chlorides of base metals, especially, are likely to be decomposed or hydrolyzed. The reaction is:



According to W. Spring (10), even sodium and potassium chlorides are partially decomposed by steam at 400 deg. C. He says that the reaction does not proceed to completion below red heat. Lead chloride, also according to W. Spring (11), begins to be decomposed by steam at 110 deg. C. Duschak, Bouton, and

Riddell (12) have studied the equilibrium of the reaction



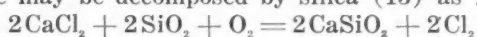
The value of the equilibrium constant found by them indicates that silver chloride is decomposed to a considerable degree by water vapor at about 1,000 deg. C. My experiments show that water vapor diluted with air decomposes also zinc chloride at temperatures as low as 500 deg. C.

REACTIONS WITH LIME

At elevated temperatures lime may react with base-metal chlorides thus:



The decomposition of base-metal chlorides by lime is a possibility, which may be favored or accelerated by certain conditions, among which is the presence of reducing agents, such as carbon, or carbon monoxide. This reaction can be prevented if a sufficient amount of silica is present. In the presence of oxygen, calcium chloride may be decomposed by silica (13) as follows:



Oxygen alone does not decompose calcium chloride (13), for calcium chloride is more stable than calcium oxide.

CONCLUSION. In conclusion, it may be said that the presence of oxygen, sulphur, and water vapor is in gen-

eral beneficial during the period of chloridization, but their presence is harmful during the period of volatilization of the base-metal chlorides. Lime has decomposing effects on the chlorides of base metals; if necessary, silica should be added to eliminate the harmful effects of lime. Silica is always desirable and perhaps necessary in chloridization if salt or calcium chloride is the chloridizing agent used.

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- (8) Gargen: *Compt. Rend.*, 102, 1164 (1886); *Ann. Chim. Phys.* (6), 10, 105 (1887).
- (9) Bureau of Mines Bull. No. 211, p. 18-19 (1923); Bureau of Mines Bull. No. 157, p. 75 (1918).
- (10) W. Spring: *Berichte*, 18, 344 (1885).
- (11) W. Spring: *l.c.*, p. 345.
- (12) Bureau of Mines Tech. Paper No. 317 (1924).
- (13) Abegg and Auerbach: *Handbuch d. Anorg. Chem.*, vol. IV, part 2, p. 86, Leipzig, 1913.

The Old and the New—in English Shovels

The photograph in Fig. 1 shows what was probably the first long-boom steam shovel ever constructed. This was purchased by Messrs. Lloyds Ironstone Co., of Corby, England, in 1900, and was made by John Wilson & Co., Ltd., of Liverpool. The boom was 70 ft. long and the bucket of 1½ cu.yd. capacity. The weight in working order was approximately eighty tons. The traveling, digging and slewing were driven from a pair of vertical engines, the thrusting gear for regulating the cut being controlled by a long double-acting steam cylinder mounted between the dipper arms. Three sets of double-flange traveling wheels were fitted to the lower framing, additional support being given to the machine by means of corner jacks extended from each of the four corners of the lower framing.

The photograph in Fig. 2 shows another interesting machine which illustrates the largest and latest type of excavator recently installed by the same company. It was constructed by Ruston & Hornsby, Ltd., Lincoln, England. This machine carries a dipper of 7 cu.yd.

capacity and is fitted with a boom 80 ft. long. The weight of the machine in working order is 350 tons.

It is of particular interest that the first and also the latest and largest type long-boom, full-circle shovels are to be found at the same mine, and that a long-boom, full-circle shovel, of the dimensions shown in Fig. 1, was introduced and put to work as far back as the year 1900 in open-cut mining work.

Ore Production in the Saltillo District

A grand total of 18,337 metric tons of ore was hauled into Saltillo, Coah., Mexico, during February, 1925, over the Coahuila & Zacatecas Railway, which serves the most important ore-producing region of the district, according to the Department of Commerce. This total is an increase of about 800 tons over that for the preceding month and is the largest monthly receipt for a period of more than a year. Shipments of lead ore and copper matte during February show substantial gains over shipments made during January. Shipments of zinc ore amounted to only 104 tons in February.

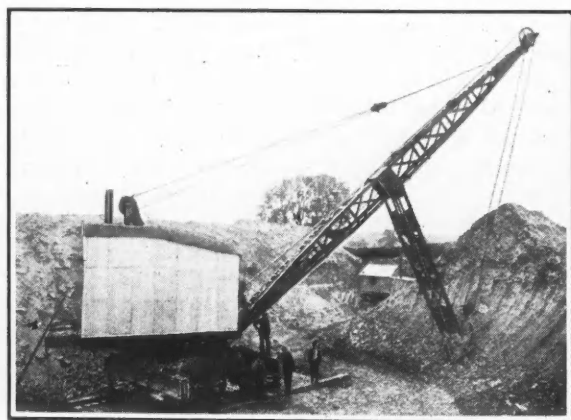


Fig. 1—Long-boom, full-circle steam shovel installed by Lloyds Ironstone Co., Corby, England, in 1900.



Fig. 2—Long-boom, full-circle steam shovel, of 7 cu.yd. capacity, installed recently by the Lloyds Ironstone Co.

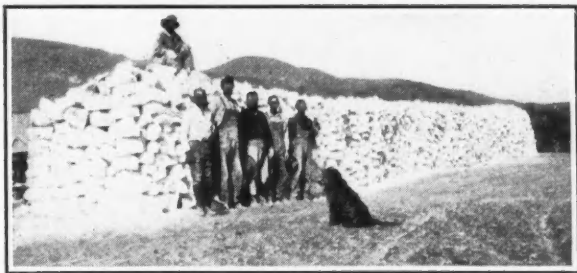
Mining Mirabilite Near Wabuska, Nev.

Description of Deposit and Method of Exploitation

By John Melhase

Geologist, Southern Pacific Co., San Francisco, Calif.

ONE OF THE LARGEST and most interesting deposits of sodium sulphate in the United States has recently been developed in Mason Valley, near the town of Wabuska, Lyon County, Nev. The deposit consists of pure mirabilite, or hydrated sodium



Blocks of mirabilite "corded up" to dry

sulphate, known also as Glauber's salts, and having the composition sodium sulphate (Na_2SO_4), 44.1 per cent, and water, 55.9 per cent. It forms in partly dehydrated crystalline crusts with a hardness of 1.5 to 2, and a specific gravity somewhat higher than the observed gravity of fresh crystals of mirabilite, which is 1.48.

Mention of this deposit was first made in 1885 by Russell,¹ who observed a crystalline mass of sodium sulphate from six to eight feet thick resting upon beds of saline clay in the vicinity of Wabuska. In December, 1923, while making a reconnaissance of the mineral resources of Lyon County, I came upon the mirabilite and made a brief examination of the deposit and the region in which it occurs.

Mason Valley is approximately 30 miles in length, from north to south, and attains a width of 12 miles near the northern end. It is hemmed in by the Wassuk or Walker range on the east, and by the Singatse range, also known as the Smith River range, on the west. These ranges converge toward the south, constricting the valley at its upper end to a width of two miles.

Both the Wassuk and Singatse ranges are composed of steeply inclined, faulted and metamorphosed sediments, with interbedded volcanics, of Triassic age, resting upon cores of granodiorite and quartz-monzonite which were injected during the early Cretaceous. The tilting and metamorphism of the Triassic rocks accompanied, and were caused by, the invasion of these large masses of plutonic rocks.

According to Knopf,² a long period of erosion succeeded the Cretaceous upheaval and the older rocks were cut away sufficiently to expose large areas of the underlying monzonite and granodiorite. This period of denudation was halted during the late Tertiary by an outburst of intense volcanic activity extending through the Miocene to the Pleistocene period. During this time the area was covered by extensive lava flows beginning with the rhyolites and ending with basalt. In

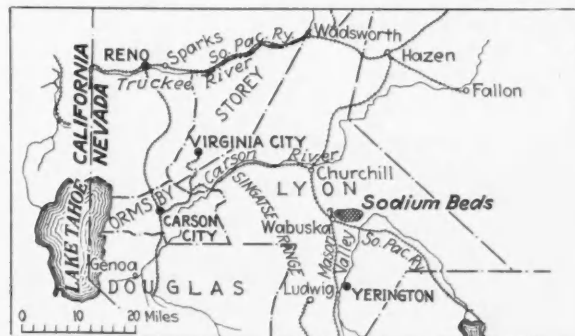
the group of hills north of Mason Valley there is a large area of Tertiary sediments, probably of Miocene age. They consist of clay, shale, and beds of low-grade lignite, and are capped by thick flows of andesite and basalt.

The floor of Mason Valley is covered by recent alluvial sand and silt, underlain in the northern part by beds of saline clay. The valley was formerly an arm or embayment of the ancient Lake Lahontan, evidence of which may be seen in the incoherent sediments and beach terraces fringing the northern end of the valley.

Faulting has been an important factor in the development of the physiography of this region. The first period of extensive faulting accompanied the invasion of the granitic rocks³ and was followed by two well-defined periods of earth movements during the Tertiary, the latter of which involved the Pliocene basalts. Minor faults involving the Quaternary sediments are also in evidence. One of these passes from east to west across the valley just north of Wabuska and has formed a 20-ft. scarp in Lahontan sediments near the edge of the basin. The course of this fault across the valley is marked by a number of hot springs which issue along its trace.

The mirabilite occurs as a playa deposit covering several square miles of the level valley floor, east and north of Wabuska. This is the lowest part of Mason Valley, and with the desiccation of Lake Lahontan the saline solutions of the embayment were concentrated in a comparatively small area, where they finally evaporated and deposited the crust of sodium sulphate.

At present the surface of the playa is characterized by numerous shallow depressions, locally termed "lakes," the largest of which covers nearly 100 acres. They range from this size down to about three acres, and are either partly or wholly separated from one another by low silty ridges. Analyses of the material forming these ridges show them to be composed of



Map of part of western Nevada

nearly equal parts of efflorescent mirabilite and silt. It is presumed that the ridges originated through the buckling of the mirabilite crust during the process of recrystallization; and that later wind-blown material found lodging and gradually increased their size.

¹Russell, I. C.: "Geologic History of Lake Lahontan," U. S. Geological Survey Mon. 11, p. 48; 1885.

²Knopf, Adolph: "Geology and Ore Deposits of the Yerington District, Nevada," U. S. Geological Survey, Professional Paper 114, 1918.

³*Idem*, p. 28.

The depressions into which the mirabilite crystallizes are bordered by wide margins of efflorescent salts from 2 to 6 in. in depth, over which a thin crust tends to form. Toward the edges of the lakes or ponds the deposit becomes deeper and firmer and merges gradually into the solid crystalline masses which constitute the minable portions of the deposit. The solid crust covering the ponds ranges from 6 to 24 in., or more, in thickness and is composed of a compact interlocking mass of partly dehydrated mirabilite crystals. It rests directly upon soft yellow mud, but occasionally there may be an inch or more of brine between. The mud itself contains as high as 50 per cent by volume of clear well-formed mirabilite crystals extending to a depth of 6 ft. and probably deeper, as the maximum depth was not determined. Holes dug in the mud fill with a saturated solution, and in a few days the mirabilite crystals begin to form, growing out from the sides and bottoms of the holes until they are filled with interlacing masses of crystals. In hot weather crystallization begins when the density of the solution reaches 30 deg. Bé., which is about 10 deg. higher than when it flows into the holes.

The solubility curve for sodium sulphate (Fig. 1) is a typical broken curve. At a temperature of 0 deg. C. the solubility is 5 parts by weight in 100 parts of water, but it increases rapidly with rise in temperature to 55 parts at 32.4 deg. C., which is known as the transition point. At higher temperatures the decahydrate, mirabilite, can no longer exist, but becomes converted into the anhydrous form, and its solubility gradually decreases to 42.5 parts in 100 at 100 deg. C.

No appreciable amounts of carbonates or chlorides occur with the mirabilite, and so far as is known they are not present in any of the sediments beneath the deposit. Analyses of typical samples of the materials occurring in and about the deposit yield the following results:

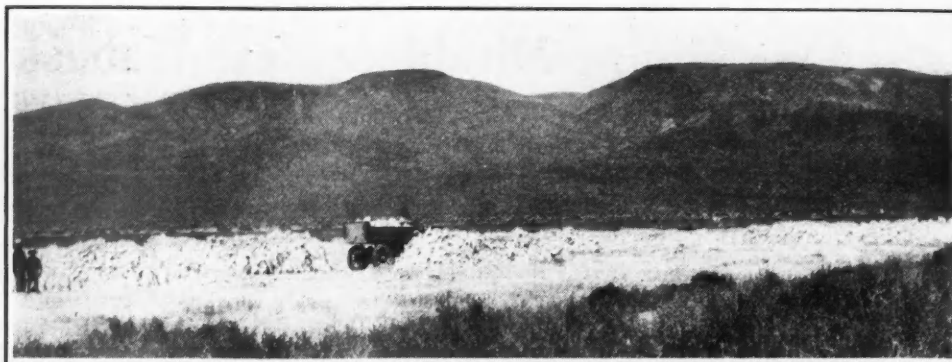
| Constituent | 1 | 2 | 3 | 4 |
|--|--------|--------|--------|----------|
| Sodium sulphate (Na ₂ SO ₄)..... | 26.70 | 42.01 | 79.65 | 98.19 |
| Sodium carbonate (Na ₂ CO ₃)..... | 0.32 | 3.97 | 0.53 | 0.13 |
| Potassium nitrate (KNO ₃)..... | 0.14 | 0.07 | 0.03 | ..... |
| Potassium chloride (KCl)..... | 0.46 | 1.33 | 0.57 | ..... |
| Sodium chloride (NaCl)..... | 0.63 | 0.28 | 0.98 | 0.23 |
| Insoluble matter and water..... | 71.75 | 52.34 | 18.29 | 0.75 (a) |
| Boric acid (H ₃ BO ₃)..... | Trace | Trace | Trace | ..... |
| Undetermined..... | ..... | ..... | ..... | 0.70 |
| Totals..... | 100.00 | 100.00 | 100.00 | 100.00 |

(a) Includes 0.23 per cent water.

- From 6-in. deposit of efflorescent salts overlying shale beds 10 miles north of Wabuska.
- Material forming the ridges on the playa at Wabuska.
- Crystalline mirabilite from crust 12 in. thick. Playa deposit at Wabuska. Undried. Average sample of large minable deposit.
- Same as No. 3, but recrystallized and dried at 110 deg. C.

In discussing the origin of the mirabilite it may be noted that Russell¹ considered it to have been deposited by the hot springs in this vicinity. While it is true that the spring waters do contain small amounts of sodium salts, they can scarcely be looked upon as the main source of this great deposit. North of Wabuska the low hills of Tertiary clays and shales are found to be covered with earthy efflorescent mirabilite to a depth of 2 to 6 in. The deposit is deepest in the ravines

¹Russell, I. C.; *Op. cit.*, p. 48.



Motor trucks are used to haul the dried mirabilite to the warehouse

and depressions, but thins out up the slopes toward the lava capping. Lavas, especially the basalts, are known to be sources of sodium compounds, and in this instance it is almost certain that leaching of the extensive flows surrounding Mason Valley has produced most of the sodium sulphate of the Wabuska deposit.

The apparent decrease in thickness of the crystalline mirabilite since the time of Russell's investigation is attributed to the effects of erosion, which, in the forty years that have elapsed, has appreciably deepened the channels leading from the playa northwesterly to Carson River. This has permitted the escape in solution of vast quantities of the mirabilite during rainy seasons, when the playa overflows. At this rate of depletion it is apparent that another twenty years would witness the complete removal of the surface deposit through natural processes, although the crystals embedded in the underlying clay would probably remain for a much greater time.

The methods employed in mining or "harvesting" the sodium sulphate are extremely simple. Where the crust is not too thick it is broken into slabs with picks and sledges, but when crusts a foot or more in thickness are encountered it is found expeditious to use powder to break them up. The resulting lumps and slabs of ore are stacked up like cordwood to dry, and after about two weeks' exposure to the desiccating atmosphere of this region the material is ready to be crushed and sacked for shipment.

The crusher used in preparing the ore is of the type used in crushing cotton-seed cake. It consists of two heavy iron rolls thickly studded with intermeshing conical steel teeth about an inch long and of the same diameter. Experiments have shown this type of crusher to be most satisfactory, as it does not clog and the crushed product contains a minimum of powdered material. The crusher has a capacity of about 100 tons in ten hours, reducing the slabs of mirabilite to a size that

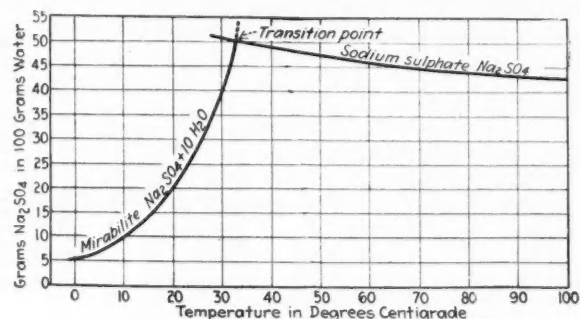


Fig. 1—Solubility of sodium sulphate in water, after Gay-Lussac

will all pass a half-inch opening. It is driven by a 40-hp. gas engine, mounted with it on a movable carriage which permits the whole to be moved about the warehouse to any desired position. The ore is fed by gravity into the crusher, and the finished product falls upon a belt conveyor, which elevates it to the storage bins.

After the original crust is harvested, it may be replenished through leaching operations, by which the ponds are flooded with water enough to dissolve the efflorescent salts around the margins and the waste from previous mining operations. Upon evaporation, a new crust will form upon the ponds within a few weeks, and the process may be repeated as long as there are any salts left in the sediments of the playa. Water for leaching purposes may be obtained from the near-by hot springs, from shallow sumps in adjacent ponds, or from an artesian source at a depth of 100 to 200 ft.

At present it is proposed to tap the artesian flow and flood some of the smaller ponds to a depth of 6 to 12 in. When the solution has evaporated the flooding operation will be repeated, and in this manner it is believed that a crystal bed of any desired thickness may be formed. Because of the aridity of the climate

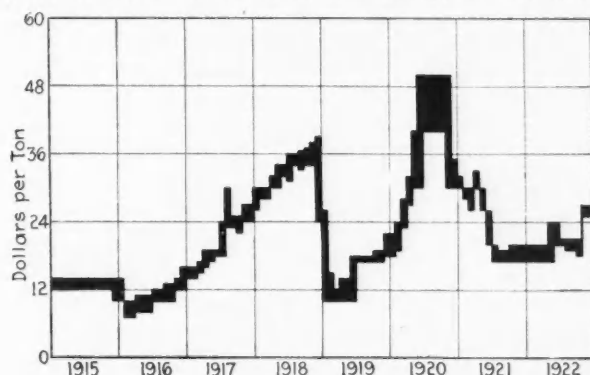


Fig. 2—Price of salt cake in New York chemical market, adapted from U. S. Geological Survey Bull. 717

these operations may be conducted throughout the greater part of the year. Also, by properly controlling the runoff from occasional rains, the precipitation may be effectually utilized in the leaching and flooding process.

Large quantities of sodium sulphate are used annually in the sulphate process of manufacturing wood pulp. This process requires from 280 to 700 lb. of salt cake per ton of pulp produced. The factories of the United States which employ the sulphate process produce about 160,000 tons of pulp annually; and Canada produced 180,000 tons; Sweden, 150,000; and Norway, 50,000 tons of pulp per year. The quantity of sodium sulphate required to supply these plants ranges as follows: United States, 22,000 to 56,000; Canada, 25,200 to 63,000; Sweden, 21,000 to 57,500; and Norway 7,000 to 17,500 tons, annually.

Sodium sulphate is also used to provide the necessary alkali base in the manufacture of various kinds of glass. For this purpose it must contain less than 1 per cent sodium chloride or sulphuric acid; less than 0.4 per cent iron and aluminum oxides; less than 0.5 per cent of matter insoluble in water; and less than 0.2 per cent of magnesium sulphate. Sodium sulphate is used in the manufacture of freezing mixtures, in dyeing, in medicine, and in analytical chemistry.

The market price of sodium sulphate is based upon

the prevailing price of salt cake, which is an artificial product obtained by treating common salt with sulphuric acid. The resultant products are hydrochloric acid and salt cake. It is also made by the Hargreave process in which salt, sulphur dioxide, air, and steam are utilized.

Fig. 2 shows graphically the fluctuations in the price of salt cake in the New York chemical market between the years 1915 and 1922. The lowest quotation during this period was \$8 per ton, in 1916, and the highest was \$50, in 1920.

Electric Waves to Locate Metals

A new electric gate checker, based on the use of electric waves, has lately been put to practical use. It has been brought into being from the number of thefts from factories, both of tools and finished or semi-finished products, and is intended to counteract this nefarious and growing habit. Hitherto, searching has been done in a more or less perfunctory and haphazard manner, a few employees being picked at random. This has been distinctly unsatisfactory. Among the honest men it has produced a hostile feeling against the firm and the measures adopted, and frequently the guilty ones have escaped scot free. Both these difficulties will be obviated by the use of the new apparatus, which thoroughly searches every employee. It also obviates the possibility of collusion between searchers and guilty employees, a circumstance that is frequently known to exist, and in the long run the new contrivance should be far less costly than is a number of human searchers. Finally, there is no bad feeling engendered, while the knowledge that the search is regular and deals with every employee should reduce the fraud element to a very narrow margin.

The invention is the work of two German physicists, Dr. Geffcken and Dr. Richter, of Leipzig. It has been carried out by Gebr. Wetzel of Leipzig-Plagwitz. The novel arrangement enables everyone leaving the premises to be examined without any physical contact, merely by walking through a special door where an electric field is generated and spreads its lines of force into the surrounding room. If the person passing through the door carries any metal pieces about him, they will have the effect of causing an alteration of the electric field.

By the use of new measuring methods and arrangements of connections an apparatus is operated indicating with absolute safety these small variations in the electric field of the door and giving out a signal calling the attention of the superintendent. The apparatus can be adjusted to allow any minor metal objects, such as watches and keys, to be taken through the gate unheeded. As the apparatus automatically records the presence of any metal object of material size, only those on whose passage the apparatus has signaled any metal will in future be searched.

A small searching coil is used and is quickly passed over the body of the suspect. This coil can, of course, be adjusted to variable sensitiveness, thus allowing such small objects as a few pennies in the pockets to be passed unheeded. The same coil can, however, be adjusted to increased sensitiveness so as to detect not only the penny in the pocket but such minute quantities of metal as the gold stopping in a tooth, with absolute safety and without contact with the body.

The idea is considered to be of great importance.

A Rapid Method of Analyzing Xanthate

Volumetric Procedure Simple and Sufficiently Accurate for Practical Purposes

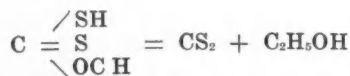
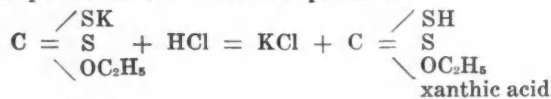
By **Wilhelm Hirschkind**

Chief Research Chemist, Great Western Electro Chemical Co.,
San Francisco

This is the third article "Mining Journal-Press" has published on the analysis of xanthate, the two previous ones having appeared in the issues of Dec. 20, 1924, and April 25, 1925. The methods given have been developed through a large amount of research work by the authors, who have represented both manufacturers and users. Xanthate has become a popular flotation reagent, particularly for selective work. It has been sold in various degrees of purity, and not, in all instances, under its own name. The editors believe that the development of satisfactory methods of estimating its purity will be appreciated both by manufacturers and flotation operators.

THE ANALYSIS of xanthate is still a topic of discussion, notwithstanding the fact that methods have been advanced by which xanthates are said to be accurately evaluated. The principle of one method recently published¹ consists in the precipitation of xanthate as cupric salt using a copper sulphate—sodium tartrate reagent, the tartrate being added to prevent the precipitation of other copper salts, except sulphides or thiocarbonates. In the presence of the last-named compounds, the results are high, but since commercial dry products are usually free from sulphides, the matter is of no great importance. The method does require, however, much care to precipitate cupric xanthate only, such as immersion in ice and constant shaking; also, the subsequent filtration and redissolving of the precipitate needs a certain amount of skill. The accuracy of the method is, according to published results, one-half of one per cent and the time required for check analysis is four hours. Moreover, the method permits no conclusion as to the nature of the impurities.

The following work was undertaken to provide a method for xanthate analysis rapid and accurate enough to serve the need of our manufacturing department and simple enough to be carried out in the average mine laboratory. The principle of the method was taken from a proposal by Bror Holmberg.² A dilute solution of xanthate is acidified with an excess of standard acid. The liberated xanthic acid decomposes within ten minutes into alcohol and bisulphide, both neutral substances, after which it is possible to titrate back the excess of acid with standard alkali. The acid consumed corresponds to the xanthate present.



The method was first used on pure potassium xanthate which was prepared from the commercial product by a double recrystallization from pure 95 per cent alcohol. A determination of total sulphur in the re-

crystallized material showed its purity to be 99.5 per cent potassium xanthate.

The results are given in Table I. The results check within 0.2 per cent.

Table I—Analysis of Purified Potassium Xanthate by the Acid Titration Method

| No. | Sample Grams | N/10 HCl Used, c.c. | N/10 NaOH Used, NF J.0953 c.c. | Potassium Xanthate Found, Per Cent |
|-----|--------------|---------------------|--------------------------------|------------------------------------|
| 1 | 0.75 | 50 | 3.60 | 99.53 |
| 2 | 0.75 | 50 | 3.50 | 99.73 |
| 3 | 0.75 | 50 | 3.55 | 99.63 |
| 4 | 0.75 | 50 | 3.52 | 99.69 |
| 5 | 0.50 | 35 | 4.15 | 99.55 |

The next and most important step was to adapt the method to commercial products containing impurities such as caustic alkalis, carbonates, thiosulphates, sulphites, and organic compounds, such as diethyl xanthate derivatives. The organic compounds in question have no action on dilute acids and alkalis, and are therefore of no influence. The same holds true for thiosulphates when only one-tenth normal acids and alkalis are used. Carbonates and sulphites can be completely removed by precipitation with an excess of a 10 per cent barium chloride solution and subsequent settling and filtration. Caustic alkalis are determined by an initial titration with tenth normal acid using phenolphthalein as an indicator, which is to be deducted from the total acid consumption.

A series of experiments were undertaken to determine the influence of these impurities. For this purpose samples were prepared containing purified xanthate with 10 per cent of its weight of the other salts. These mixtures were analyzed according to the outlined principle, and the results are given in Table II. The xanthate found is expressed in per cent of the xanthate sample only, so as to make the results comparable with the ones in Table I. The results as shown

Table II—Analysis of Mixtures of Purified Potassium Xanthate With Other Salts by the Acid Titration Method

| No. | Xanthate, Grams | Impurity, Grams | Procedure | N/10 HCl, c.c. | N/10 NaOH, NF J.0953 c.c. | Potassium Xanthate, Per Cent |
|-----|-----------------|---|--|----------------|---------------------------|------------------------------|
| 6 | 0.75 | 0.075 NaOH | ..... | 70 | 24.70 | 99.28 |
| 7 | 0.75 | 0.075 Na ₂ CO ₃ | Addition of BaCl ₂ and filtration | 50 | 3.48 | 99.80 |
| 8 | 0.75 | 0.075 Na ₂ SO ₃ | Addition of BaCl ₂ and filtration | 50 | 3.52 | 99.69 |
| 9 | 0.75 | 0.075 Na ₂ S ₂ O ₃ | ..... | 50 | 3.50 | 99.73 |

in this table demonstrate the feasibility of the acid titration method for commercial xanthate.

The procedure for the analysis of xanthate can now be given in detail. Sulphides or thiocarbonates are assumed to be absent, which is usually true in dry samples. However, the qualitative tests as given below should always precede the analysis.

1. Reagents:

1. N/10 solution of hydrochloric or sulphuric acid.
2. N/10 solution of sodium or barium hydroxide.

¹Engineering & Mining Journal-Press, Vol. 118, p. 980 (1924).
²Berl. B. Vol. 46-1-3, p. 3853, 1912.

3. Phenolphthalein indicator.
4. Methyl red indicator prepared by dissolving 0.2 gm. methyl red in 100 gm. boiling water, filtering, and cooling.
5. A 10 per cent solution of barium chloride.
6. A 2 per cent solution of sodium nitroprusside.
7. A 10 per cent solution of lead acetate.

Procedure for Analysis

1. *Test for sulphide:* A 1-gm. sample of xanthate is dissolved in 100 c.c. cold water and a few c.c. of a 2 per cent solution of sodium nitroprusside added. The immediate appearance of a violet or blue color indicates sulphide.

2. *Test for Thiocarbonate:* A 1-gm. sample of xanthate is dissolved in 50 c.c. cold water and a few c.c. of a 10 per cent lead acetate solution added. If the precipitate, which is formed immediately, has a red or brown color, the presence of thiocarbonates is indicated.

3. *Available Xanthate:* 7.5 gm. of xanthate are dissolved in 50 c.c. cold water and washed into a 250-c.c. graduated flask. From 10 to 20 c.c. of a 10 per cent solution of barium chloride are added to the contents of the flask, with shaking, after which the solution is diluted to 250 c.c. and allowed to settle, which requires but a few minutes. The clear supernatant liquor is poured through a dry folded filter and the filtrate tested as follows:

Into a 250-c.c. beaker 25 c.c. are pipetted and two drops phenolphthalein added. If a pink color appears, indicating the presence of caustic, N/10 acid is cautiously added until the disappearance of the color. Note acid consumption, *A* c.c.

Then, 25 c.c. of the filtrate are pipetted into a 250-c.c. beaker, 50 c.c. N/10 acid added with stirring, and the liquid allowed to stand for ten minutes. Three drops of methyl red indicator are then added and the excess of N/10 acid titrated back with N/10 caustic until the red color changes to yellow. Note alkali consumption, *B* c.c.

Calculation:

$$50 - (A + B) \times \frac{16.03}{\text{wt. of sample}} = \text{per cent potassium xanthate}$$

$$50 - (A + B) \times \frac{14.42}{\text{wt. of sample}} = \text{per cent sodium xanthate}$$

Duplicate determinations require approximately 30 minutes, though two sets can be run easily in that time. They should check within 0.3 per cent.

DETERMINATION OF IMPURITIES

A determination of all impurities present can easily be run in conjunction with the xanthate analysis. Since the methods to be used are standard practice, it shall suffice here to give only a general description. The determination of caustic alkali is given above. Thiocarbonates may be determined in the same sample used for xanthate titration. The titrated sample which has been neutralized with N/10 caustic is acidified again with N/10 acid and then titrated with N/10 iodine solution. The iodine consumption indicates directly the thiosulphate present. 1 c.c. = 1 per cent. Sulphites and carbonates are determined in the precipitate obtained with barium chloride. Two equal samples of xanthate are dissolved and precipitated with an excess of barium chloride solution. The two precipitates are

filtered and washed. One of them is ignited at a low red heat to determine the weight of barium carbonate plus barium sulphite. The second one is dissolved in dilute acid to which a certain amount of N/10 iodine solution has been added. After complete solution is obtained, the excess of iodine is titrated back with N/10 thiosulphate solution. The iodine consumed indicates the amount of sulphites present, and by deducting the sulphite from the weight of the precipitate, the carbonate content is ascertained. The content of volatile matter, consisting of water and alcohol, is obtained by drying a sample in a vacuum desiccator.

Example of a complete analysis of commercial potassium xanthate:

| | Per Cent |
|--|----------|
| KX..... | 94.70 |
| K ₂ CO ₃ | 1.90 |
| K ₂ S ₂ O ₃ | 3.16 |
| K ₂ SO ₃ | .20 |
| Volatile matter..... | ..... |
| | 99.96 |

All xanthate solutions, especially those coming from various steps of the xanthate manufacturing process, but also solutions of the pure solid product, on standing show the presence of sulphides or thiocarbonates. Sulphides or thiocarbonates are also occasionally found in solid products and always in semi-solid pastes, owing to the mother liquor they contain. The analysis of xanthate products carrying sulphides or thiocarbonates necessitates a modification of the method just described. The method as described provides for an acidification of a sample from which the carbonates have been removed. The acid liberates xanthic acid, which is decomposed, on standing, into alcohol and bisulphide. If sulphides or thiocarbonates are present, hydrogen sulphide, or hydrogen sulphide and carbon disulphide respectively are liberated. If one works in such a dilution that all hydrogen sulphide liberated remains in solution, one can, by a carefully conducted back titration, determine the excess of acid as well as the hydrogen sulphide liberated, and therefrom calculate the xanthate as well as thiocarbonates or sulphides.

Procedure—A 5 to 10-gm. sample of liquid or paste is weighed out, washed into a 250-c.c. graduated flask, 10 to 22 c.c. of a 10 per cent barium chloride solution added, diluted to 250 c.c., and allowed to settle. The clear liquor is poured through a folded filter and 25 c.c. of the filtrate titrated as follows: Add an excess of N/10 acid, approximately 50 c.c., and allow to stand 10 minutes. Then add three drops of methyl red and titrate back with N/10 caustic until the red color changes to yellow. Note alkali consumption *A*. Then add phenolphthalein indicator and titrate to appearance of a pink color, which takes place when one-half of the hydrogen sulphide has been neutralized. Note alkali consumption, *B*.

Calculations:

$$50 - (A + 2B) \times \frac{16.03}{\text{wt. of sample}} = \text{per cent potassium xanthate}$$

$$50 - (A + 2B) \times \frac{14.42}{\text{wt. of sample}} = \text{per cent sodium xanthate}$$

$$2B \times \frac{5.5135}{\text{wt. of sample}} = \text{per cent K}_2\text{S};$$

$$\text{per cent K}_2\text{S} \times 1.6908 = \text{per cent K}_2\text{CS}_2$$

$$2B \times \frac{3.903}{\text{wt. of sample}} = \text{per cent Na}_2\text{S};$$

$$\text{per cent Na}_2\text{S} \times 1.9752 = \text{per cent Na}_2\text{CS}_2$$

Table III

| No. | Xanthate, Grams | Sulphide Added | Thiocar- bonate Added | N/10 HCl NF. u.0953 c.c. | N 10 NaOH NF. 0.0953 Methyl Phenol- Red phthalein | Xan- thate Per Cent |
|-----|--------------------|---|-----------------------------|--------------------------------|--|---------------------------|
| 10 | 0.75 | ..... | ..... | 50 | 4.3 | 92.3 |
| 11 | 0.75 | 2.5 c.c. normal Na ₂ S | ..... | 60 | 9.2 | 93.1 |
| 12 | 0.75 | 5.0 c.c. normal Na ₂ S | ..... | 60 | 4.5 | 92.7 |
| 13 | 0.75 | ..... | Indefinite amount | 60 | 7.5 | 93.0 |

Table III will show the influence of sulphides and thiocarbonates. The accuracy of the analysis is not so great as in sulphide-free samples, but accurate enough for all practical purposes.

For a complete analysis, including all impurities, the outline given for the solid material may be followed except that the iodine titration gives both sulphides and thiosulphates, from which the sulphides, as determined according to above outline, have to be deducted.

The foregoing methods are based upon experience in analyzing large numbers of samples of crystal xanthates, solutions thereof, and the mother liquors incident to the manufacture of xanthates on a commercial scale. They are easily workable and provide means for accurate analysis of commercial xanthates in the presence of any impurity which is likely to be present. They also provide means for the quantitative determination of impurities.

South African Diamond Production in 1924

Diamonds produced in the Union of South Africa during 1924 totaled 2,440,398 metric carats, valued at £8,033,406, an increase of almost 400,000 carats in weight over 1923, and of approximately £200,000 in value, according to the Department of Commerce. The sales, however, were 2,040,655.6 carats, valued at £6,752,499, or 543,614 carats less than in 1923, in which year they amounted to 530,000 carats above the production. The average value realized per carat was 66s. 2d., as compared with 59s. 10d. in the preceding year.

Out of the total output, 2,135,262 carats came from thirteen mines, two of which are in the Transvaal, three in the Cape Colony and eight in the Orange Free State.

Production of alluvial diamonds during the year amounted to 287,555 carats, valued at £2,150,373. The average value realized for these stones was 149s. 7d. per carat. From the standpoint of carats produced, 1924 was a record year for the alluvial diggings. The total production of both mineral and alluvial diamonds for the fourteen years for which statistics are available was as follows:

Total Production of Diamonds in the Union of
South Africa, 1911-1924

| Year | Metric Carats | Estimated Value | Sale Value per Carat |
|------|---------------|-----------------|-------------------------|
| 1911 | 5,021,734 | £8,746,724 | 34/2 |
| 1912 | 5,206,388 | 10,061,489 | 39/1 |
| 1913 | 5,300,483 | 11,389,807 | 42/6 |
| 1914 | 2,875,299 | 5,487,194 | 39/2 |
| 1915 | 106,127 | 399,810 | 51/6 |
| 1916 | 2,408,554 | 5,728,391 | 44/5 |
| 1917 | 2,979,388 | 7,713,810 | 49/9 |
| 1918 | 2,604,650 | 7,114,867 | 53/4 |
| 1919 | 2,656,651 | 11,734,495 | 98/5 |
| 1920 | 2,612,511 | 14,762,899 | 113/11 |
| 1921 | 828,035 | 3,013,448 | 79/5 |
| 1922 | 669,559 | 2,266,631 | 61/2 |
| 1923 | 2,053,094 | 6,038,207 | 59/10 |
| 1924 | 2,440,397 | 8,033,406 | 66/2 |

Salaries and wages paid to white employees in 1924 amounted to £878,978. This is slightly more than in 1923, when £841,320 was paid.

Mining and Milling Diatomaceous Earth in California

Diatomaceous earth occurs in a belt running along the eastern foothills of the Santa Lucia Range in California. One of the latest developments is that of the Monterey Products Co., described in "Mining in California" for January, published by the California State Mining Bureau.

This company and its subsidiary, the Monterey Insulated Brick Co., Inc., controls 3,900 acres under a 50-year lease, of which 100 acres cover a deposit of diatomaceous earth. The deposit is a part of the old Saucito Rancho grant, owned by T. A. Work. It is situated on the Salinas-Monterey highway four and one-half miles from Monterey. Shipments from Monterey can be made by either rail or water.

The exact extent of the deposit has not been definitely determined, but it has been shown to extend over a considerable area. It is believed to have an average depth of 300 ft. of soft diatomaceous earth and is roughly estimated to contain from 7 to 10 million tons. The material so far exposed is very pure. It is of marine or salt water origin, and is said to contain a large percentage of unbroken diatoms. The surface consists of rolling hills, partly covered with live oak. The elevation at the plant site is 160 ft. above sea level. Water is obtained from springs.

At the point where mining operations were begun there is no overburden, but in other places the diatomaceous earth is covered or partly covered by other formations. Mining is by the open-cut method in benches with pick and shovel. The material, as mined, is passed down a chute to the mill by gravity. The mill building and warehouse are of corrugated iron over a wooden frame, set on concrete foundations. Electric power, furnished by the Pacific Gas & Electric Co., is used throughout, there being a substation on the property.

At the bottom of the chute from the working face, the material is fed to a conveyor belt, which carries it to toothed rolls. From the rolls it is taken by bucket elevator to an oil-fired revolving drier. A suction fan draws off the steam and air from the drier, and this pipe is arranged so that the discharge may be passed through one or more, up to eight, cyclone separators, where the fine material carried over is collected. The coarse material from the drier is elevated to two bins, each 20 ft. square and 30 ft. deep. From these bins the dried earth goes to a K-B hammer mill for pulverizing. An air blast picks up the discharge from the hammer mill and blows it through a pipe to a single long settling bin, the coarser material settling out first and the finer farthest from the pipe discharge. Excess air from this bin, carrying a very fine product, is passed through another cyclone, where the very finest material is collected. Sacking devices are located at intervals under the long bin so that any grade desired may be sacked.

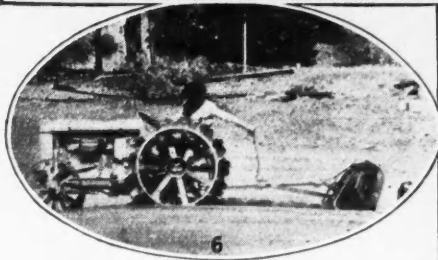
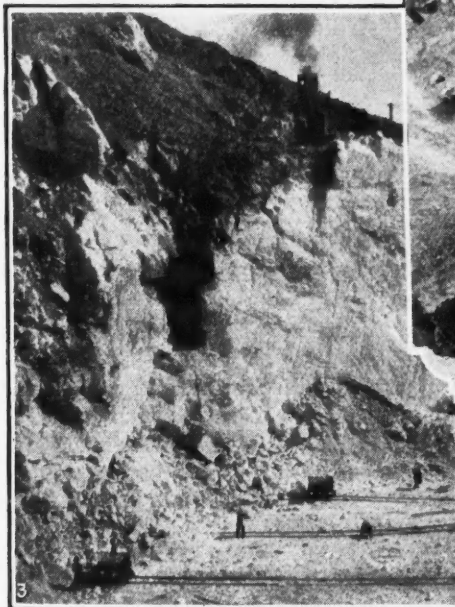
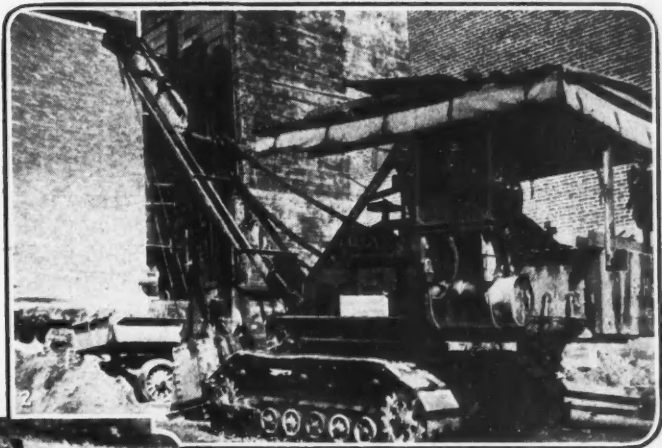
After being placed in bags, the material is stored in the warehouse, which has a capacity of twenty cars of finished product. The capacity of the plant is 30 tons in 8 hours. The Monterey Products Company's output is sold under the trade name of "Calatom" and is used for filtration purposes in the manufacture and refining of sugar, yeast, oils, and lard. It is used also in the making of dynamite, as a soap filler, as insulation in bake-ovens and boilers and in polishes.

Useful Operating Ideas

Loading Materials in Small Operations

Small quarries, sand, gravel, and clay pits, and thin spread-out deposits of various kinds are just as adaptable for loading by mechanical appliances as larger

farm tractors for hauling is common practice. Loading the gathered material can be accomplished by the small revolving type of power shovel, mounted on traction wheels or caterpillars, or by bucket-elevator loader. Where the deposits are more concentrated, the re-



1. Loading in magnesite quarry with electrically operated shovel. 2. Gasoline-operated tractor shovel. 3. Stripping by steam shovel in gypsum quarry. 4. Loading sand in excavation work with portable bucket loader. 5. Loading gypsite with scraper. 6. Excavating a gold dredge pit with tractor and scraper. 7. Steam shovel with traction wheels

operations. The plow and scraper are used on the earthy deposits that are spread out over considerable areas and are characteristically thin. The use of small

volving type of power shovel is especially suitable for loading all coarse or rocky material. The smaller shovels, $\frac{3}{4}$ to 1 cu.yd., are especially suitable for the work

of stripping overburden and loading into cars or auto-trucks. Two types have been developed for this purpose, the tractor-truck type and the caterpillar traction type. Steam, internal-combustion engine, and electric-motor drive are available in shovels of both types. The caterpillar traction shovel is suitable for soft ground and wet pits, and the tractor-truck type for firm ground.

For loading soft, finely divided materials the bucket-elevator loader mounted upon caterpillar trucks and driven by an internal-combustion engine is especially suitable. By the use of manganese-steel buckets, gritty materials can be economically loaded. This type of loader is of general utility for loading from the pile, sand, gravel, and finely crushed rock. It is operated by one man and will load at the side or end.

For excavating and loading clays and sticky material generally, the revolving power shovel is better than any other device. It is sufficiently rugged in construction to stand up under the harder work of excavation. Caterpillar tractors are suitable for wet, soft pits.

For undercutting or excavation in pits beneath the general surface where considerable water is to be encountered, the small dragline excavator is useful.

Reducing Spillage Losses in Shoveling

At the El Paso smelter, El Paso, Texas, the device shown in the accompanying illustration is used in unloading ore cars where hand shoveling is necessary. It consists of a sheet-iron hopper which is provided with hooks for attaching to the side of a car. In



Unloading hopper for non-dumping railroad cars

addition, two short legs bear against the side of the car and give the proper angle to the hopper. A sheet-iron plate is placed against the car and prevents any pieces that roll off the wheelbarrow from falling into the space between the platform and the railroad car.

Handling a Long Hoisting Rope

At the Kennedy mine, at Jackson, Calif., the replacement of a hoisting rope is carried out in a rapid and simple manner. The shaft is 4,462 ft. deep and is vertical, and the hoisting cable is 1½ in. in diameter and 4,500 ft. long. The new rope is delivered on the usual wooden spool. A spare wooden spool is mounted



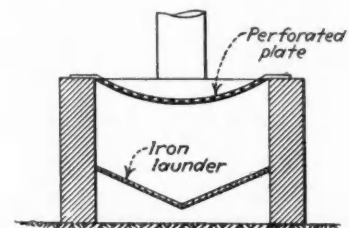
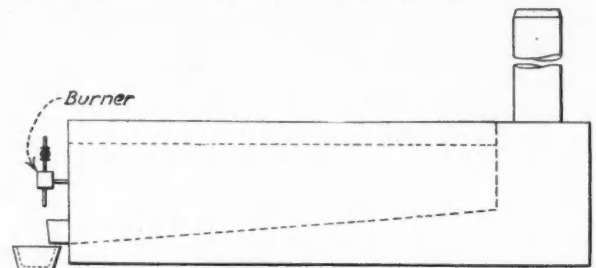
Eight hours suffice to transfer the rope

upon a shaft and boxes which are supported on heavy wooden jacks. A light cast-iron grooved wheel is bolted to the wooden spool. The wheel is turned by a rope which passes several turns around a gypsy on the prolongation of the shaft of a small gear-driven hoist. This hoist is permanently mounted a short distance in front of and to one side of the main hoist, which is to the right in the accompanying illustration.

The old rope is detached from the skip and the end made fast to the empty spool; then it is wound up under tension, and when the end is reached on the main drum it is detached and fastened to the short rope on the auxiliary drum. The hoisting rope is then completely wound on its spool, pulling the short rope over the sheave and down to the ground level. It is then detached and made fast with rope clamps to the end of the new hoisting rope. This is pulled up and over the sheave and down to the hoist, where it is attached to the hoisting drum. The new rope is then wound upon the drum. The end is fitted into a thimble and the rope clamps are attached. It is then ready to be fastened to the skip. The job takes eight hours.

Simple Liquefaction Furnace

A simple liquefaction furnace for removing the surplus lead from the dross skimmed from lead-drossing kettles at the El Paso, Texas, smelter is shown in the accompanying illustration. The furnace is a rectangular brick structure provided with a stack and oil burner. The top plate is curved and perforated with holes at regular intervals. A V-shaped iron plate forms the bottom. The dross is spread out on the upper plate and just enough heat used to sweat the lead out.



Liquefaction furnace for lead skimmings

Discussion

The Ward Method of Meridian and Latitude Determination

THE EDITOR:

Sir—In common with several other people, I am greatly interested in the Ward Method of Meridian and Latitude Determination as published in your issue of May 16. I take it that you know it will work or you would not publish it. I think that Mr. Ward owes it to his readers to show how he obtained his factors for the two stars he uses. In fact, the article would have been much more interesting if he had shown exactly how the whole thing was worked out. I have figured it out for myself, but most people, I imagine, will not take the trouble to do so. Also unless the factors are given for succeeding years or the method of finding them is given, the method will not be of much use to most people.

JAMES UNDERHILL.

Idaho Springs, Colo.

THE EDITOR:

Sir—Mr. Underhill suggests in his letter that many, who may find my method of meridian and latitude determination useful, would like to derive the necessary factors for their own use in succeeding years. I am planning to publish the tables annually in pocket size to fit a standard field book, and undoubtedly many will prefer these to the necessity of calculating the factors, though they would only require those needed for their latitude.

The theory:

(a) If two stars transit at the same moment (have the same right ascensions), but at different altitudes (have different declinations), their distances from the pole remain constant, and all functions (altitude, azimuth, etc.) depending on these constants will continue constantly proportional.

(b) Two stars, whose transits are separated by a given time interval, may be treated as transiting at the same time, if the transit of the first be observed, the interval be allowed to elapse, and then the transit of the second be observed.

(c) As the functions of the stars remain (practically) proportional throughout their apparent daily cycles, observations may be made at any time, and the constant proportions (factors) are applicable.

(d) As the difference of time in transit, the relative right ascensions, and the declinations gradually vary in their annual cycle, new proportions must be used when the variance exceeds the desired limit of error.

So much for theory. Practically the only necessities are a copy of the American Ephemeris and Nautical Almanac (\$1 a copy from the Superintendent of Documents, Washington, D. C., and available about eighteen months in advance of Jan. 1) and a good set of logarithmic tables (I use Vega, seven place tables, and interpolate closely).

The formulas are:

$$(1) \text{ Sin azimuth} = \frac{\sin(90^\circ - \text{declination})}{\cos \text{latitude}}$$

The greatest declination and least declination during the year are taken from the almanac and averaged for each star. Azimuth for each star is then calculated by (1) for each degree of latitude.

(2) Alkaid factors =

$$\frac{\text{Azimuth Polaris}}{\text{Azimuth Alkaid} + \text{Azimuth Polaris}}$$

(3) ϵ Cassiopeiæ factors =

$$\frac{\text{Azimuth Polaris}}{\text{Azimuth } \epsilon \text{ Cassiopeiæ} - \text{Azimuth Polaris}}$$

Formulas (2) and (3) are self-evident.

(4) The times of transit (upper or lower culmination) of Polaris and each of the other stars are taken from the almanac for the first and fifteenth of each month, and the time of transit of Polaris is subtracted from the time of transit of each of the other stars (± 12 hours if necessary) to give the time intervals.

(5) Refraction is a standard table, obtainable from various sources.

I should also like to point out that the Alkaid factor being about as 1:40 and the ϵ Cassiopeiæ factor being about as 1:25, errors of observation, refraction, time interval, etc., are reduced 1/40 or 1/25, the practical limit being the accuracy with which the derived angle may be laid off. The method and tables may be used throughout the Northern Hemisphere, Europe, Asia and North America. With a proper choice of stars, similar tables might be derived for the Southern Hemisphere.

I trust that I have given sufficient information to make the method clearer and more generally useful, and express my appreciation of the interest expressed by Mr. Underhill.

HOWARD R. WARD.

Wharton, N. J.

The Frozen Tundra

THE EDITOR:

Sir—During a stay in the North in which I have covered a wide area in the course of prospecting work in permanently frozen ground, I have noticed that in each locality, generally in the lower areas, there is a finely divided, dark, earthy material, called muck, which is of variable thickness, with vein-like ribbons and pockets of ice incorporated within it. This frozen muck is covered by a mossy and other plant growth, commonly from 1 to 2 ft. thick, the whole of which acts as an insulating agent as may be observed. During the warm season the surface is thawed and on the approach of winter it freezes back to the permanent frost. If this green, mossy mat be broken, which is done during the warm season in the course of placer mining, the mucky material disappears like the proverbial snowball, leaving a great hole in the landscape, the accumulation perhaps of centuries disappearing in a few days. I wish that prospectors in their work in the North might be accompanied by trained observers, for I feel that their observations would have yielded a fund of useful information.

H. L. STOKES.

Nome, Alaska.

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

CERRO DE PASCO has increased copper production in Peru to 6,500,000 lb. per month. Final settlement with all stockgrowers within 22 miles of Oroya, arising from smelter smoke damage claims, will be accomplished soon, it is confidently expected.

Increase in the capacity of its Great Falls zinc plant from 15,000,000 to 20,000,000 lb. per month has been announced by the Anaconda company.

The transfer of the Bureau of Mines from the Interior to the Commerce Department has been ordered by the President.

Statistic gathering activities of trade associations are legalized by a sweeping decision of the Supreme Court.

International Smelting Co. is buying complex zinc ores in Colorado for treatment at its Tooele plant.

Utah Copper Co. has completed a handsome new clubhouse for its employees at Garfield.

Development at the Amulet property in the Rouyn district in northwestern Quebec is reported as very promising.

The Federal M. & S. Co. is using selective flotation in the treatment of ore in the Joplin-Miami district.

The construction of a concentrator by the Ahumada Lead Co. may follow experiments now being made on the ore.

Activity in the Gilbert district, west of Tonopah, Nev., is increasing, though no large shoots are reported.

Market for Complex Zinc-Lead Ores Helps Colorado

International Smelting Co. Is Purchaser—Renewed Activity at Leadville

More energy than has been displayed in recent years marks work in Colorado's non-gold-producing districts.

The outstanding work in progress is that of the Leadville Deep Mines Co., under the direction of George Argall. He has practically completed the unwatering of the Graham Park basin and is now producing on a small scale. Present production is low-grade iron sulphide and the zinc-bearing complex ore which remained exposed at the time of the forced discontinuation of pumping in the Wolfstone, Greenback and Pyrenee shafts. Development is progressing as the lower workings are being freed of accumulated debris.

The Canterbury Tunnel, the Leadville community enterprise, is being advanced as rapidly as financial resources will admit and is penetrating ground which even now is of ore-making character. However, the tunnel must reach Evans basin before much is expected.

The Eagle Picher Lead Co., in its desire for clean lead ore, is developing by drills the "break" in the granite, of which the old Terrible mine at Ilse, Custer County, is a part. Its past production was lead carbonate ore entirely free of silver or impurities. The drilling seeks to develop other lenses of similar ore, unmarked on the surface beyond the occasional indicative coloring extending with the break for

several miles each side of the Terrible.

The old mines of Lake City, in Hinsdale County, are being revived one by one, due to the present lead market and the needs of the International Smelting Co. for ore amenable to selective flotation to supply its mill at Tooele, Utah.

Rico, in Dolores County, is also being revived. The ore is largely zinc-bearing and can be sold either to the International company or to the A. S. & R. Co. at Durango, where it is subjected to the sulphating process. This sulphating plant, which has been utilized during recent months for the recovery of cadmium from the flue dust accumulated at the blast furnaces of the A. S. & R. plants, is now being returned to service in the recovery of zinc in sulphate form from the complex ores.

The Sunnyside mine, near Silverton, maintains its steady production of both silver-lead and zinc concentrates, and has recently added materially to the life of its ore supply by developing new bodies of large extent and of equal grade to past production.

Rotarians Get In Deep!

Upon the invitation of T. H. O'Brien, general manager, and Harold W. Aldrich, assistant superintendent, the Miami and Globe Rotary Club held a regular meeting recently on the 400 level of the Inspiration Consolidated Copper Co.'s mine. Mr. Aldrich is president of the local Rotary Club. During the meeting Clyde Weed, assistant to the general manager, made an address, explaining the workings of the mine.

Active Development in Eureka District in Utah

Iron King Strike Important—Silver Shield Will Sink Additional 200 Ft.

Officials of the Iron King mine, situated in the East Tintic district, near Eureka, Utah, report that the new strike on the 1,100 level near the new shaft is the most promising made in the history of the property. Another heading has been started on the 1,100 level and drifting discontinued on the 900 in order to prospect the new ore exposure.

Operations have been resumed in the Empire Mines Co. property of the Knight Investment Co. Under the direction of H. R. Trenholm, cutting of the station has been started. As soon as this work is completed three promising fissures are to be prospected on the 1,800 level. Upper levels will be worked by leasers and connection is to be made between the Lower Mammoth workings and the Black Jack, both of which groups belong to the Empire Mines.

Contracts for sinking the Independence shaft of the Silver Shield Mining Co. an additional 200 ft. to the 631 level will be awarded soon. A hoisting engine and new compressor are being installed. The Silver Shield company some time ago sold its Bingham holdings and has been acquiring a large acreage in the Tintic district.

A tunnel is to be run in the Diamond Queen mine to connect with the 400 level of the shaft. When the connection is made, sinking of the shaft will be resumed.

Federal M. & S. Uses Selective Flotation in Joplin-Miami District

THE Federal Mining & Smelting Co. will rebuild the concentrator at its Whiskbroom mine in the Joplin-Miami district during the coming summer. The mine is located just to the north of the property of the Anna Beaver Mining Co., southwest of Picher, Okla. A number of line holes were put down by the two companies recently, and a good body of ore was indicated.

The rebuilt mill will be equipped for selective flotation. Almost all the Federal's mills in this district have been so equipped in the past few months. Two of the mills have four flotation machines and five others have either two or three.

The Federal recently took over the Bendene lease, south of Baxter Springs, Kan., and is drilling it.

To date, the Federal has shipped more ore than any other mine in the district this year. P. W. George, of Baxter Springs, is district manager.

Ahumada Erupcion Interests May Build Concentrator

The Ahumada Lead Co., operating in Mexico, has declared the regular dividend of 7½c. and an extra dividend of 17½c. payable July 2, 1925, to stockholders of record June 15. The Erupcion Mining Co. declared the regular dividend of 7½c. and an extra dividend of 12½c., payable on the same date. With the payment of the July dividend, a total of \$1.20 per share will have been paid, more than reimbursing original investors for the price of their stock. In addition to its reserves of high-grade lead ore, Ahumada has a very large tonnage of low-grade in portions of its property, these lying alongside the better grades, and generally such ores have not been considered of value because they have been difficult to treat. Tests are being made in the experimental mill of the New Cornelia Copper Co., at Ajo, and results indicate that a method for treating the ore profitably may be developed. In that event a mill may be built near the mine.

Rico Argentine Will Resume Shipments to Utah Smelters

A new 2,000-ft. tramway is being constructed by the Rico Argentine Mining Co., operating at Rico, Colo. A large tonnage of ore assaying 80c. in gold, 7 oz. silver, from 1 to 2.5 per cent copper, 20 to 26 per cent zinc, and from 12 to 22 per cent lead has been opened in the Rico Argentine, according to Fred Price, manager. The ore lies in lime replacement deposits from 20 to 50 ft. wide and from 6 to 15 ft. thick. A new compressor is to be installed, more men employed, and shipments resumed when the new railroad tariffs on shipments to Salt Lake smelters become effective.

News From Washington

By PAUL WOOTON
Special Correspondent

Hoover Gets Bureau of Mines for Commerce Department

No Connection Between Transfer and Bain Resignation—
Opportunity for Industry to Suggest Changes in Policy

IF THE Bureau of Mines, in the fifteen years of its existence, has failed in any way to measure up to the expectations of the mining industry, an opportunity now is offered to revamp its activities so as to eliminate any mistakes that have been made or to establish new policies intended to be more helpful. As had been forecast in this correspondence, the President, on June 4, by Executive order, transferred the bureau from the Interior to the Commerce Department. Secretary Hoover of the latter department immediately announced that no policies would be formulated until there has been full discussion with the associations connected with the industry as well as with representatives of mine labor and others interested in the safety work of the bureau.

The formal announcement of the transfer came from the Secretary of the Interior. His statement follows in full:

"The President today issued an Executive order transferring the Bureau of Mines and the Minerals Statistics Division from the Department of the Interior to the Department of Commerce. The change is one of the reorganization plans approved by the Joint Congressional Committee. The President has a limited authority under the organic act creating the Department of Commerce to make such shifts. It does not apply to other departmental changes, which must await Congressional authority. There are other functions which will be transferred from the Department of Commerce to the Department of the Interior when such authority is available.

"In the Interior Department, which has jurisdiction over the administration of the public domain, including the national parks, the Indian reservations, the conduct of geological and topographical surveys and the reclaiming of arid and semi-arid lands, the Bureau of Mines has not been associated.

"Its transfer, with the Division of Mineral Statistics, from the Department of the Interior to the Department of Commerce has been resolved upon as part of the program of better grouping of federal functions, according to that major purpose, it being proposed to create in the Department of Commerce a division embracing activities of the government scientific and economic research in aid to industry.

"The primary objects of such segregation are, of course, to secure economy in administration and more efficient relationship with the public. As instances of the large areas of overlap between the departments of Commerce and Interior in these functions, the following may be cited:

"Our investigations show that the laboratories of the Department of Commerce carry on scientific research in the use of gasoline and lubricating oils in gas engines, while the Bureau of Mines carried on research generally into gasoline and petroleum products. The research laboratories in the Department of Commerce carry on investigation into the quality of materials for manufacture of porcelain, whereas the Bureau of Mines laboratories carried on research into raw materials for porcelain manufacture. The Department of Commerce laboratories carry on investigation into the qualities of fuel, whereas the Bureau of Mines laboratories tested fuel as to its qualities. The Department of Commerce contains a division for service in domestic distribution and foreign trade in mineral products; the Bureau of Mines carried on work of economic character of much the same implication. The Department of Commerce provides statistics of mineral production every ten years—in some cases every two years—whereas the Department of the Interior provides statistics of mineral production every year and in many cases every month. The Department of Commerce recruits statistics on production of explosives every two years, while the Bureau of Mines procures statistics on their production at regular intervals. The Department of Commerce carries on investigations into safety appliances in various industries, while the Bureau of Mines carries on the same as applied to the mining industry. The Department of Commerce carries on research into the tensile strength of wire rope generally for all industries, whereas the Bureau of Mines investigates the strength of wire ropes for the mining industry. The Department of Commerce maintains economic research in use of raw materials for manufacture, a large portion of which are minerals, while the Bureau of Mines investigates the production of raw materials for manufacturing purposes.

"While by constant adjustment, conferences and the appointment of cooperative committees, a considerable amount of the actual duplication has been eliminated during the last four years, nevertheless such duplications cannot be eliminated and the confusion of citizens in dealing with different government departments for different purposes cannot be planed out unless single-headed authority is given for functions having the same general major purpose.

"Over a year ago I recommended to the Joint Committee on Reorganization of the Executive Departments that the Bureau of Mines should be placed in the Department of Commerce. The

transfer made today presages action by the Congress and opens the way for the transfer to the Department of the Interior of bureaus from other executive branches of the government administering public lands and public works as recommended by this committee."

In denying reports that he had resigned as a protest against the transfer of the bureau, H. Foster Bain, the retiring director, issued the following statement:

"My attention having been called to reports that I resigned in protest against the transfer of the Bureau of Mines to the Department of Commerce, I wish to state that there is no relation between the two events whatever. I am resigning with regret, because I do not feel able longer to make the financial sacrifice involved in remaining in the government service. I am going to a position which I feel is of equal usefulness and fortunately pays much more.

"As for the Bureau of Mines, it had so far been developed largely in that portion of its field which has relation mainly to the public lands, public property, and service for the government itself. Its broader field of service in promoting safety and efficiency in the mineral industries of the whole country is one which may be better developed in the Department of Commerce, where the bureau will be closely associated with the Bureau of Foreign and Domestic Commerce, the Bureau of Standards, and others related.

"That division of the Geological Survey which handles the collection of mineral statistics will, on the other hand, go with the Bureau of Mines to the Commerce Department, which thereafter will have a well-balanced, compact organization for studying the economic as well as technical phases of the mineral industries. The whole move should result in clarifying and simplifying the situation.

"It is especially fortunate that it is made at a time when Mr. Hoover is head of the Department of Commerce. There should be no doubt that so experienced and able a mining engineer will see that in the transfer and readjustment the mining industry will gain rather than the reverse."

Secretary Hoover gave public expression to the regret he feels that Mr. Bain is leaving the bureau. He pointed out that Mr. Bain has been one of his close personal friends for thirty years and characterized him as one of the outstanding men connected with the industry.

The Bureau of Mines will continue to occupy its present quarters in the Interior Building. As some time is certain to elapse before the new director will be chosen, Dorsey Lyon has been recalled from the West to take up again the duties of that office. Due to the extended absences of Director Bain in the dispatch of foreign assignments, Mr. Lyon has served as acting director for a considerable portion of the time during the past two years. It is understood that he is in no sense a candidate for the vacancy. He is much more interested in the metallurgical side of the bureau's work, of which he has been in immediate charge for a number of years.

Two Trade Associations Get Clean Bill of Health From Supreme Court

Reverses Former Maple Flooring and Cement Decisions—
Wide Importance Attached to New Findings

A SWEEPING DECISION clarifying the legal view of trade association activities in gathering and distributing statistics was handed down by the United States Supreme Court June 1, when decrees of lower courts enjoining the Maple Flooring Manufacturers Association and the Cement Manufacturers Protective Association under the Sherman anti-trust law were reversed.

The decision was by a divided court, six to three. The majority opinion was delivered by Justice Stone, the newest member of the court, who, as Attorney-General, had given considerable study to the question of trade statistics at the request of the Department of Commerce. Justice McReynolds entered a vigorous dissent in each of the two cases on the ground that the tendency of the activities complained of by the government clearly was to enrich the members of the associations by controlling production or prices or both to the detriment of the consumer. Chief Justice Taft and Justice Sanford dissented in each case on the ground that the evidence brought these cases within the rule laid down by the court previously in decisions sustaining decrees against the American Column & Lumber Co. and the American Linseed Oil Co.

The majority opinion, however, holds that in these previous cases clear intent to evade the law was established, while in the case at issue now circumstances were different.

The principal decision was read in connection with the decree issued by the District Court in Michigan against the Maple Flooring Manufacturers Association, et al. There are seventeen non-members making hardwood flooring and a total of fifty-eight non-members in the industry in the United States, but members of the association represent 70 per cent of the production. The association gathered and distributed statistics of production, stocks, unfilled orders, and average sales prices; it published a book giving railroad rates from Cadillac, Mich., to about 1,000 points in the country, and members held meetings at which statistics and other matters were discussed. These things in themselves do not constitute restraint of trade, the majority opinion holds.

The Cement Manufacturers Protective Association operated along similar lines of gathering and distributing information. In addition, in this case the question of distributing information regarding specific job contracts was involved. The government sued in the District Court of Southern New York for an injunction, alleging violation of the Sherman law, and was given a decree. Justice Stone, for the majority of the Supreme Court, predicated his opinion in the cement case on that in the flooring manufacturers' case, adding that information regarding specific job contracts was not violative of the law because it had not been established

that contractors suffered, but merely that the system protected manufacturers against contractors who might take advantage of such contracts for cement if the market was favorable. Concluding, the majority opinion says:

"We decide only that trade associations or combinations of persons or corporations which openly and fairly gather and disseminate information as to the cost of their product, the volume of production, the actual price which the product has brought in past transactions, stocks of merchandise on hand, approximate cost of transportation from the principal point of shipment to the points of consumption, as did these defendants, and who, as they did, meet and discuss such information and statistics without, however, reaching or attempting to reach any agreement or any concerted action with respect to prices or production or restraining competition, do not thereby engage in unlawful restraint of commerce."

Select Site for \$90,000 Federal Oil-Shale Plant

The oil-shale experiment plant, for which Congress appropriated \$90,000, probably will be located on a site two miles west of Rulison, Colo., on the Denver & Rio Grande Western, according to F. B. Tough, chief petroleum engineer of the U. S. Bureau of Mines.

Tough and members of his party recently visited Rulison and also made a reconnaissance survey of a proposed site twenty miles from Grand Valley on the East fork of Parachute creek. Engineers are now making a survey of the Rulison location. According to Tough, a tram at Rulison would cost more to erect than at Parachute creek, but necessary road construction at the latter site would be much costlier than at Rulison, and the latter is favored for that reason.

Estimates are now being made on the approximate cost of trams at the two locations, and if the cost is found to be excessive, it will be necessary to choose another site, Tough said.

Allenby Mill Being Reconditioned

Reconditioning a branch of the Kettle Valley Railroad, from Princeton to the property of the Allenby Copper Co., at Copper Mountain, B. C., is proceeding in expectation of shipments of copper concentrates from the mill at Allenby, four miles from the mine.

The movement of concentrates to the smelter of the Consolidated Mining & Smelting Co., at Trail, B. C., is expected to begin in August. The production of 20,000,000 lb. of copper annually is expected to result from operations of the Allenby company when operations in the mine and mill reach capacity. The Allenby is controlled by the Granby Consolidated Mining & Smelting Co.

Melbourne Letter

By Peter G. Tait
Special Correspondent

Co-operative Treatment and Power Plants Offer Economy

Kalgoorlie Operators Must Help Themselves Before Government Will Aid—Good Zinc Metallurgy

Melbourne, May 4—As an indication of the increase in the cost of mining in Western Australia, the case of the Sons of Gwalia may be quoted. In 1914 working costs were 17s. 7d. per ton, whereas for the year 1924 the figure was 26s. 9d. As a result of this increase it does not pay to mine the same grade of ore as formerly, and as a matter of fact 81 per cent of the ore reserves are below the grade now being worked. The Sons of Gwalia is 159 miles from Kalgoorlie, but as it is equipped with a modern plant, it has an advantage over the Kalgoorlie mines, where the costs stand at about the same figure. Comparatively speaking, this is a creditable result when it is remembered that the wages are higher at Gwalia than at Kalgoorlie. Moreover, the Gwalia mine is worked by an incline shaft about 4,000 ft. in length.

The commissioner appointed by the government to inquire into the present position of the industry has been questioning some of the Kalgoorlie witnesses regarding a central treatment plant, a central power plant and the co-operative purchase of stores. These are directions in which costs might be reduced. There is no reason why several of the Golden Mile companies should not sell their ore to a central treatment works on assay—in the same way as they buy tributors ore at present—and yet retain their individuality. By working along these lines, it is quite possible costs might be reduced a couple of shillings a ton, which would make a material difference in the profit and loss account at the end of the year. It is evident that the companies must first help themselves if they expect the government to help them. The evidence so far whets one's appetite to hear what the commissioner will have to say.

G. C. Klug, a leading Australian mining engineer who is now associated with Bewick, Moreing & Co., London, after spending a few months visiting Australian mining fields, expressed his conviction that Broken Hill developments both on the north and south ends of the field augur well for the prolongation of the life of the mines. The work being done metallurgically is maintaining a high standard, and sound progress has been made, particularly in regard to the treatment of the crude ore for the production of both lead and zinc concentrates at some of the larger mines. At Port Pirie the Broken Hill Associated Co.'s works continue in the front rank of lead metallurgy, as regards both efficiency and progress.

Mr. Klug said he was much impressed by the fact Australia had placed itself in a sound position by the good progress made in the development of the steel industry by the Broken Hill Proprietary Co. at Newcastle. The headway made

there was most commendable. The development of the zinc industry at Risdon by the Electrolytic Zinc Co. of Australia was also a very fine achievement. The work done by this company on the west coast of Tasmania in connection with the mining and metallurgical development in the handling of the complex ore of the Hercules and Roseberry mines had impressed him favorably. While on the west coast of Tasmania he had visited Mount Lyell. Great metallurgical advancement had been made there since his last visit, and it reflected credit on the management.

Toronto Letter

By Our Special Correspondent for
Northern Ontario

Favorable Situation at Rouyn Reflected in Shares

Amulet and Noranda Both Popular—May Gold Output for Ontario New Record

Toronto, June 6—Information coming from the Rouyn district of northwestern Quebec emphasizes the importance of the new discovery on the Amulet property, and engineers state that it looks as good as the Noranda in the same stage of its development. The ore is a rich copper-gold and is now reported to have been proved for a width of 50 ft. and a length of 300 to 400 ft. A couple of weeks ago stock in this company, which is capitalized at \$2,000,000, was selling at 35c. a share; at the present time the price is over \$1. Noranda shares of \$100 par are being dealt in at \$500 and the active bidding for the stock is taken as an indication of an early settlement of the railway troubles.

At the present time the Hollinger mine in Porcupine is treating 5,500 tons a day, and it is expected that this will be increased to 6,500 tons a day by the end of the year. At the recent annual meeting the president definitely put the company on record as going ahead with a larger program. At the present rate of dividends of 8c. every four weeks, the total will amount to \$4,378,800 in a year.

Developments at the Dome property also continue to be favorable, and the recently discovered orebody in the Keewatin formation on the north flank of the sediments is developing better than expected. Several other discoveries of minor importance have been made, and the general feeling regarding the property is one of optimism.

It is understood that the gold output for May from the northern Ontario mines amounted to \$2,600,000, another new high record; this is at the rate of more than \$31,000,000 for the year and this rate will no doubt be increased before long.

Engineers representing the American Smelting & Refining Co. are examining the Hattie property in the Painkiller Lake section. If the examination is favorable and the company takes over the property, it will agree to spend \$100,000 yearly and split the profits—55 per cent to the American Smelting & Refining Co., and 45 per cent to the Hattie company.

London Letter

By W. A. Doman
Special Correspondent

Sothorn Holland Cautious in Statements Regarding Platinum Shares Decline on Selling From South Africa—Various Interests Negotiate With Soviet

London, May 26—A considerably wider circle than the shareholders read that part of the speech of Sir Sothorn Holland at the annual meeting of the Central Mining & Investment Corporation a few days ago, relating to platinum in South Africa. Largely through its interest in the Transvaal Consolidated Land & Exploration Co. the Central Mining has obtained a big grip upon the deposits, and in other ways its holding is enlarged. If, therefore, the deposits both in Lydenburg and Waterberg persist, and mining becomes profitable, the experience of the Rand Mines, Ltd., are likely to be repeated.

Sir Sothorn Holland remarked that it was too early yet to attempt to give any estimates of the potentialities of either district. Generally speaking, his attitude is regarded as wise, though the speculators were disappointed. Whatever the reason, shares are sliding back a bit under the lead of sales from Johannesburg. On the T. C. L. farm, "Onverwacht," excellent values have been encountered. Shaft No. 1 has reached a depth of 100 ft. The average value from 80 to 90 ft. is 41.3 dwt. per ton, from 90 to 100 ft., 14.6 dwt. per ton, and for the whole depth of the shaft, 24.2 dwt. That these values are not isolated seems clear from the fact that from the bottom of the shaft four crosscuts are being put out north, south, east, and west. Latest information shows them to have advanced 6 to 12 ft., the average value of the samples taken at 3-ft. intervals being 37.7 dwt. per ton. No. 2 shaft, sunk in the western margin of the outcrop and partly outside the orebody, has disclosed variable values, but a cross-cut at 50 ft. connecting with No. 1 shaft has disclosed an average value of 25.9 dwt. per ton. "Encouraging values" are reported at other points.

Whatever the final results, other Russian mining companies besides the Russo-Asiatic Consolidated and the Lena Goldfields have carried on negotiations with the Soviet Government. It is announced that the Ayan Corporation, formed in 1921 by the New Consolidated Gold Fields, the National Mining Corporation, and others to acquire alluvial gold mining properties in the Okhotsk district of eastern Siberia, has obtained a concession contract for a period of thirty-six years on terms "considered to be satisfactory to the corporation." Ross B. Hoffmann is now on his way to Okhotsk in order to carry out an investigation.

Negotiations for a working agreement between the East Rand Proprietary Mines and the Cinderella Consolidated are proceeding through the medium of a commission, but nothing definite has yet been arranged.

New Utah Copper Clubhouse Is Luxurious Edifice

Overlooks Great Salt Lake Near Arthur Mill at Garfield—
Open to All Employees

SITUATED at the Arthur plant of the Utah Copper Co., overlooking the gray-green expanse of Great Salt Lake, has been built what is perhaps the most beautiful and luxurious employees' club in the West. The term "employees' club" belies the appearance of this artistic building, for a millionaires' club could scarcely be more richly appointed and advantageously planned. Every appurtenance in the way of comfort and amusement has been supplied by the Utah Copper Co., at an expenditure exceeding \$100,000. As beautiful as is the Robert C. Gemmell Memorial clubhouse at Bingham in careful planning, general convenience and economy of space, it cannot be compared with the Arthur clubhouse, just dedicated.

The exterior of the new structure is gray stucco with Spanish copper tile and brick trimmings. Flood lights in ornamental lamp standards illuminate the building. On the first floor is a large lounge luxuriously furnished in green Spanish leather upholstery. This room is surrounded by a large mezzanine floor, furnished with overstuffed furniture in brown and blue velour. The mezzanine is used as a reading, writing and music room. A fine grand piano has been supplied.

At one end of the lounge is a large fireplace. Bronzed memorial plates with the names of employees who served in the World War are given a conspicuous place. Opening from the lounge is a ladies' rest room and a small banquet room, adjoined by a completely equipped kitchen.

A gymnasium and ballroom, 60 by 90 ft., is entered from the lounge-room. Balconies, accommodating 750 spectators, flank th's on two sides. The balconies are equipped with orchestra chairs. A movable stage can be installed in the gymnasium for entertainments and theatrical performances.

Downstairs on the ground floor is a lounge 40 by 60 ft. with a fireplace.

Bowling alleys, pool and billiard tables, showerbaths, locker rooms, card tables, and the custodian's living quarters are found on this floor.

Walls and ceilings of the building have been decorated in keeping with the character of the various rooms. The woodwork throughout is birch; the floors are all of hardwood. Across the entire front is a screen porch furnished with tables and comfortable chairs. Membership in the club is open to any employee of the Utah Copper Co., the Bingham & Garfield Railway and the Garfield Improvement Co. Dues are \$1 a month.

B. E. Mix, chief plant engineer, is president of the Copper Club; A. C. Ensign, assistant superintendent of the Magna plant, vice-president; William Hicks, treasurer, and De Witt Burlingame, secretary. B. L. Jones is custodian.

The board of directors consists of F. O. Haymond, general superintendent of the Bingham & Garfield Railway; Roy Hatch, superintendent of the Arthur plant; E. W. Engelman, superintendent of the Magna plant; J. G. Hadley, employment director; L. A. Barker, metallurgical engineer of the Magna plant, and B. W. Haymond, engineer, Bingham & Garfield Railway.

Additional photographs will be found on page 956 in this issue.

Copper Leaching Experiments at Butte

A. G. Siebenaler & Son are installing an experimental leaching plant to treat the ores of the Consolidated Metals Co. at Butte, Mont. If this work is successful, the properties will be operated on a good scale. The Consolidated Metals Co. controls the Butte-Duluth and Bullwhacker mines in the eastern portion of the district. These properties contain large orebodies of copper carbonates and silicates, lying close to the surface.

Gilbert Grows, but Actual "Ore" Is Still Scarce

Large Area and Good Assays Hold Out
Promise—Lessees Busy and Digging
May Open Sizable Orebodies

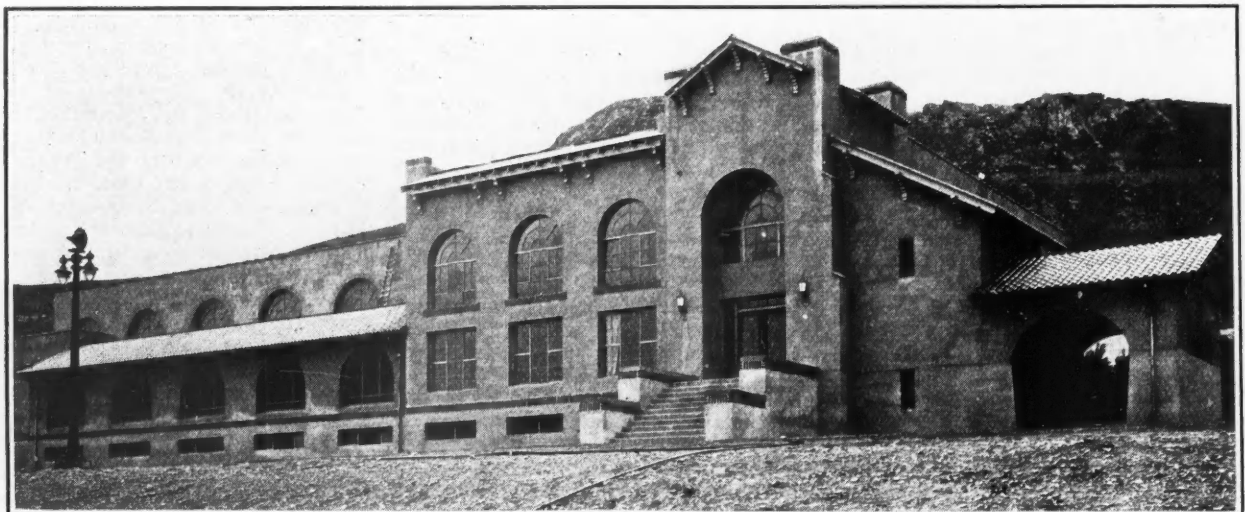
Gilbert is having a mild boom. The latest gold camp in Nevada, situated 29 miles westerly from Tonopah, is growing; many property transfers have been made and considerable work is being accomplished.

On the Last Hope claim, or original strike, no work has been done at the point of discovery for many months. The 26-ft. shaft and 40-ft. crosscut from the bottom both show some ore. One carload of ore which ran about \$26 per ton was shipped from this work. No well-defined vein was disclosed by this work, the values being found in a silicified rhyolite or rhyolite breccia, but it was thought that the ore had a northerly strike and westerly dip. With this idea in mind, the main vertical shaft was located to the west of the surface discovery. An easterly crosscut is out 140 ft. on the 112-ft. level, but it has failed to cut the downward extension of the surface find, although seams and small stringers were cut which showed colors when panned.

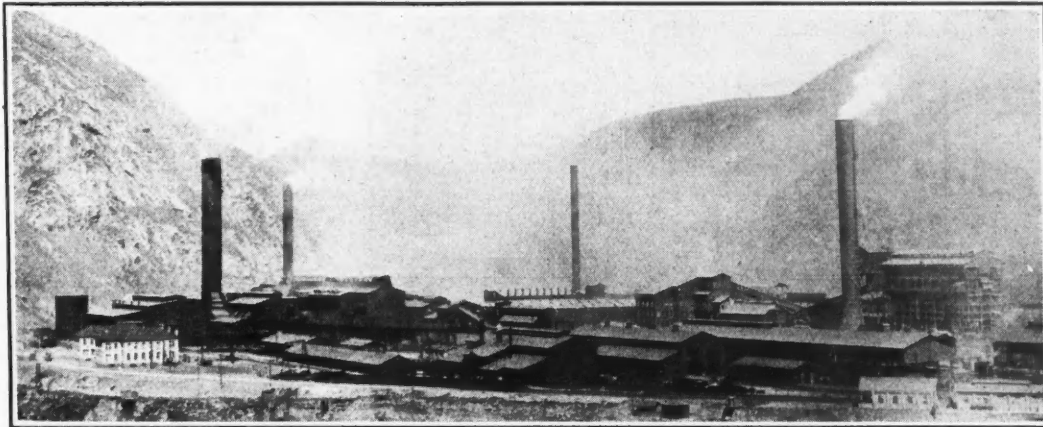
About 150 ft. south of the original discovery, also on the Last Hope claim, a leaser has found values at a depth of 12 ft. and is taking out ore for making a shipment. This ore may be found to be a continuation of the original strike mentioned above. This find has stimulated the various leasers on this claim and they are busy.

To the south, on the Black Mammoth claim, owned by the same company as the Last Hope, gold was found on a large, prominent silicified outcrop. Practically no work was done on the outcrop, but a northerly drift tunnel has been run under the surface ore and some crosscutting has been already accomplished. Good values have been found and some ore is being saved, but the vein is reported to be badly crushed at present.

On the Homestake claim of the Gilbert Homestake Mining Co., situated east of and adjoining the Mammoth, several veins have been traced on surface,



New Clubhouse for Utah Copper Employees near Arthur Mill.



Cerro de Pasco smelter at Oroya, Peru

A thoroughly modern plant finished in 1923. Though operating at reduced capacity it is giving splendid results.

followed downward by shafts to as much as 70 ft. below the surface, and have been cut in crosscut tunnels. These veins are not large, rarely over 2 ft. in thickness so far as developed, but they contain good shipping values and in the near future should produce an appreciable tonnage of ore. The size of the oreshoots is problematical as yet, as drifting has not progressed far enough to determine their length. The Homestake claim is divided into lease blocks and active work is being carried on at several places. Control in the Homestake company has been purchased by a group headed by M. J. Monnette, once a miner in Goldfield and now a Los Angeles banker; and the company is reported to be well financed for extensive work.

Free gold has been found over a large area and many properties have promising showings the actual value of which can be proved only by work. The district extends for a distance of roughly 10 miles northerly and southerly, which appears to be the general strike of the veins, with a varying width up to several miles.

With the limited work done and the many gold showings throughout the district, it seems reasonable to believe that a high-grade body of ore of commercial size may be found at any time, which will furnish the fuel for a real boom. However, the permanent success of Gilbert depends, of course, upon the production of ore in paying grade and quantity. Production to date has been small, probably not more than 100 tons in small shipments which returned from \$26 to \$85 per ton, but it is generally believed that during the next few months rate of production will be increased. If values and widths, as published by some of the active companies, are any criterion, there should be large shipments made which will run several hundred dollars per ton.

Gold Ore in Shasta County

M. G. Henry, who has control of a large group of claims in the Harrison Gulch mining district in Shasta County, Calif., has opened a 14-ft. vein containing free gold in a 1-ft. strip along the footwall. The vein is believed to be that which produced well in the nearby Midas mine.

Cerro de Pasco Increases Copper Output to 6,500,000 Lb. Monthly

Final Settlement With "Smoke Farmers" Near—Silver Production High—Splendid Work at Oroya Smelter

By A. B. Parsons
Assistant Editor

WHAT with conflicting reports of settlement with stock raisers whose washed out railways, adverse complaints have the underlying cause awards to "smoke farmers," flooded of curtailed production for the last mines, and government orders to curtail twelve months. Net income from sales smelter operations, and also a dearth of official statements regarding any of these things, the present situation of the Cerro de Pasco Copper Corporation about \$2,000,000 came from customs

Consolidated Income and Expenditure Account, Jan. 1, 1924, to Dec. 31, 1924, of Cerro de Pasco Copper Corporation and Subsidiaries

| Expenditures | | Income | |
|---|-----------------|--|-----------------|
| Inventory—Copper, silver, and gold—Dec. 31, 1923 | \$5,793,896.32 | Sales—Copper, silver and gold | \$20,836,688.70 |
| Operating, smelting, shipping, refining, administration, etc. | 10,432,834.50 | Freight and passenger earnings | 1,429,905.84 |
| Custom ores | 2,381,886.03 | Dividends, interest, and miscellaneous earnings | 524,361.39 |
| United States and foreign taxes | 948,619.41 | Inventory—Copper, silver, and Gold—Dec. 31, 1924 | 4,863,822.30 |
| Balance to consolidated surplus account | 8,097,541.97 | | |
| | \$27,654,778.23 | | \$27,654,778.23 |

in Peru is not crystal clear to the public. The information in this article is from sources that are believed to be reliable, but, as the investment bankers warn, it is not guaranteed.

Any large increase in the gross production of the corporation for 1925 over that of 1924 is unlikely, although negotiations are virtually completed for

ores. An estimate in round numbers of the output from the company's own mines is 75,000,000 lb. of copper and 15,000,000 oz. of silver. During the first five months of 1925 output was about 4,000,000 lb. of copper monthly and 1,000,000 oz. of silver, the ratio of silver to copper being somewhat higher because of the desire to produce the largest possible income with only one reverberatory furnace in operation at the new smelter at Oroya. A second reverberatory is available, but as a measure of diplomacy this furnace was shut down in the middle of 1924 and has been idle until recently. Current production with two furnaces running, at much below maximum capacity, is about 6,500,000 lb. of copper and 1,250,000 oz. of silver. A still further increase will be necessary to bring copper output to that of last year, though silver production apparently will be higher.

The new smelter is exceeding expectations in the efficiency of the work done. In spite of the enticement of



Part of Peru

The recent washouts were west of Matucana



Cerro de Pasco's Morococha mine

The central shaft is in the foreground. Behind are the "cuts" for the railroad

available "cheap" labor, the plant is mechanicalized to the highest degree; and the low operating costs have proved the soundness of the policy followed in the design of the plant of minimizing manual labor. One reverberatory, designed to smelt 600 tons per day, handled 900 for a long period; and the fuel consumption was only 1 ton of oil to 20 tons of ore. It is understood that a third reverberatory may be built in spite of the fact that two blast furnaces were provided when the smelter was erected and are now idle. Apparently the comparative economy of reverberatory smelting of Cerro de Pasco ores has been established.

Contrary to some reports, the company did not curtail production materially because of the unusually heavy storms and subsequent floods that washed out or buried a large part of a twenty-eight-mile section of the road of the Central Railway of Peru, which connects Oroya with Callao, the seaport. The only change was to substitute powdered coal for oil as fuel at the smelter in order to conserve the available supply of oil in case of a more acute emergency. The company operates its own coal mines, and transportation between them and Oroya was at no time interrupted, as there were no washouts on the lines of Cerro de Pasco's own railroad. Likewise

traffic between the mines at Cerro de Pasco and Morococha was unaffected. It was, of course, impossible to ship blister copper to Callao, and consequently the current output was stored at Oroya. This stock now is being depleted rapidly.

The floods that washed out the line of the Central Railway began about the middle of February. The trouble arose principally from the swollen streams on the lower portion of the line. The Central Railway has long been notable for the fact that it reaches the highest elevation of any railroad on the globe, but it was not in the extremely high, rugged country that the washouts occurred.

That traffic was resumed on May 16, about three months after the first washout, is due to a very creditable feat of engineering in restoring the line. In this the Cerro de Pasco railway staff played an important part. It immediately started to clear the line from the Oroya side while the Central officials worked from the other side of the washed-out section. The accompanying photographs give some idea of the work; the tracks in many places were shifted considerable distances or were buried under many feet of gravel and rock.

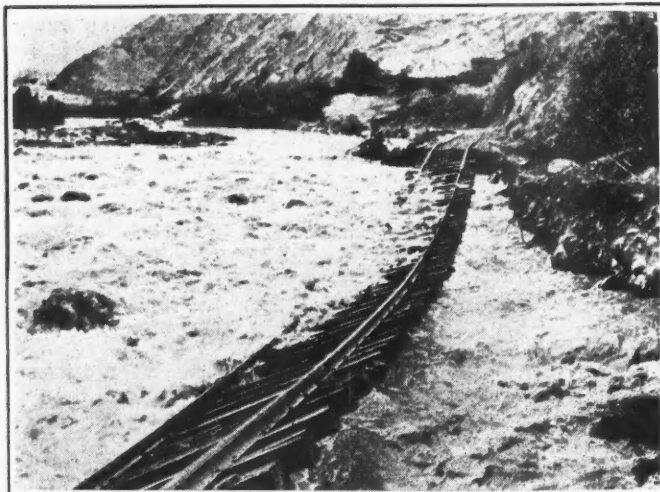
During the three months when the railway was out of commission, needed

light mine supplies, food, and other stores were transported around the gap by pack animals, but several consignments of heavy machinery necessarily were held up. These included pumps for the Morococha mine and a large amount of equipment for the new Cottrell treaters at Oroya. The delay of three months in the delivery of this material was the most serious result of the washout.

The Morococha mines form a separate property 100 miles from Cerro de Pasco, but they are very important contributors to the company's output. Early this year an exceptionally heavy flow of water developed unexpectedly and the lower workings filled up to the drainage tunnel level. This difficulty is what is referred to in reports as "water troubles." Two electrically driven deep-well Layne & Bowler pumps of large capacity were ordered from the United States. These were shipped a little too late to get to Morococha before the floods. They have now been delivered and one pump is installed and in satisfactory operation. Several months probably will be required to free the mine of water completely.

The Cottrell equipment likewise has reached the smelter by this time and installation will be rushed. The treater will handle the gas and fumes from the converters only. If it proves satisfactory, additional units may be added for the other furnaces.

However, the delay neither in the Cottrell plant construction nor in the installation of the Morococha pumps has been the controlling factor in the curtailment of production. The second reverberatory was shut down voluntarily by the company as a measure of diplomacy pending the settlement of with stock growers who owned land in the vicinity of the new smelter. Oroya is seventy-five miles from the site of the old smelter at Fundicion; it is at a much lower elevation, though at some distance from valuable grazing lands. Recently the government, as a consequence of a report by an official



On the line of the Central Railway in Peru

Left—Tracks washed out by swollen streams following heavy rains of February. Right—Clearing away the debris that covered the tracks in many places. The road was out of commission for three months.



investigating committee, has ordered the company to indemnify some of these claimants for damage in an amount totaling 3,634 Peruvian pounds. This is a comparatively small sum. Negotiations are virtually completed with most of the land owners within about twenty-two miles of the smelter whereby the Cerro de Pasco company either has acquired the property or settled permanently with the owners. When agreements have been reached with all potential claimants for damage, the way will be cleared for operation of the smelter at as near maximum capacity as is desired.

Ontario's Gold Output, \$5,829,000 for Quarter, New Record

Big Gain in Nickel Over 1924—Cobalt District Shows Decrease in Silver Production

The report of the Ontario Department of Mines shows that the output of the metalliferous mines, smelters and refining works for the three months ended March 31, 1925, had a total value of \$14,349,000, as compared with \$11,575,000 for the corresponding period of the previous year. The production of the more important metals was as follows:

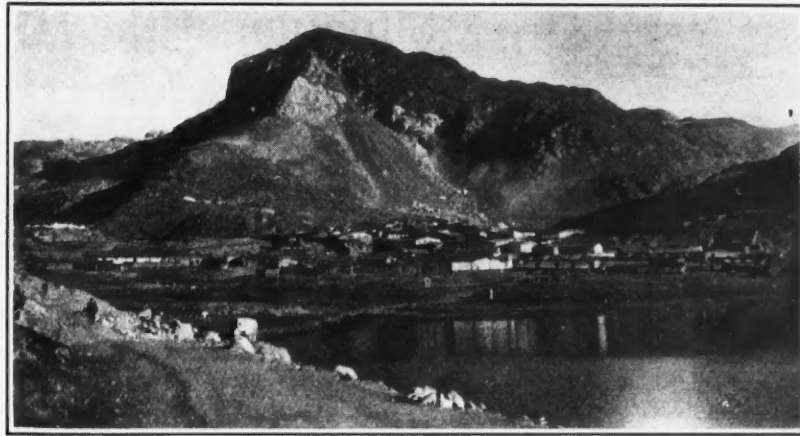
| Product | 1924 | 1925 |
|-------------------------------|-------------|-------------|
| Gold..... | \$5,735,882 | \$6,949,636 |
| Silver..... | 1,532,694 | 1,702,120 |
| Copper (metallic)..... | 644,483 | 681,926 |
| Copper in matte exported..... | 219,360 | 356,726 |
| Nickel in matte exported..... | 656,700 | 1,142,216 |
| Cobalt, metallic..... | | |
| Cobalt, oxide and..... | 406,205 | 550,319 |
| Cobalt, salts..... | | |
| Nickel, metallic..... | 1,614,712 | 2,083,141 |
| Lead, pig..... | 85,581 | 111,323 |

Copper and nickel exported in the form of matte were valued at 8c. and 15c. per pound, respectively. The output of gold, amounting to \$6,993,000, established a new high record in the history of the province; gains were reported from both Porcupine and Kirkland Lake, amounting to \$685,000 in Porcupine and \$508,000 in Kirkland Lake, representing an increase of 13.3 per cent and 78 per cent, respectively. The total output from Porcupine was valued at \$5,829,000 and from Kirkland Lake \$1,159,000. The production of silver shows an increase due to shipments from Gowanda and South Lorrain, although there was a slight falling off by the mines of Cobalt. Companies shipping over 400,000 oz. per quarter were Nipissing, 885,000; Mining Corporation, 464,000, and Keeley, 421,000.

During the quarter 304,000 tons of nickel-copper ore was smelted and 16,600 tons of matte produced.

Michigan Mill, Never Used, Now Being Dismantled

The Michigan stamp mill at Keweenaw Bay, Michigan copper district, owned by Mohawk, has been dismantled. The plant never was operated, construction work having been discontinued when about 80 per cent completed. Much new and second-hand supplies and equipment, and usable timber in oak trestle, planking in rock bins, mill floors, has been shipped to the Mohawk mine and mill.



Town of Morococha showing Potrero mountain and Morococha Lake in the foreground

Anaconda Will Increase Zinc-Plant Capacity One-Third

J. R. HOBBS, vice-president of the Anaconda Copper Mining Co., announces that the directors have authorized an increase of approximately one-third to the present capacity of the Great Falls zinc plant in Montana. Construction will be begun immediately. The present plant, which is the largest zinc refinery in the world, has a capacity of 15,000,000 lb. per month and will be increased to 20,000,000 per month. When the plant is in operation it will require an additional 150 men and an additional 15,000 hp. of electricity, to be furnished by the Montana Power Co.

Float Old Lead-Silver Tailings at Tombstone

The old lead-silver mill-tailings dump at Contention City, near Fairbanks, Ariz., which has remained practically untouched since the days when Tombstone was at its peak, is now being successfully treated by Louis Douglas and Harry Hendrickson. Contention City was the site of the early mills, the ore being brought to this location in order to take advantage of the water in the San Pedro River.

The dump contains approximately 100,000 tons, having a metal content of 5 per cent lead and 5 oz. silver. For many years the dump remained untreated, owing to metallurgical difficulties, but by heating the water before turning it into the ball mill, and adding the proper mixture of sodium sulphide, the present operators are successfully treating the tailings in a K. & K. flotation machine. The mill, which has a capacity of from 100 to 130 tons a day, probably holds the record for economical construction in the state. Around 10 to 12 tons of concentrates is being turned out daily, carrying about 50 per cent lead and 25 oz. silver. The concentrates are piped from the mill to drying platforms built along the railroad, from which they are shoveled into cars when the moisture has evaporated.

Four Joplin-Miami Zinc Shippers Pass 16,000-Ton Mark

The shippers of zinc ore in the Joplin-Miami field that had passed the 10,000-ton mark by June 1 were as follows:

Federal Mining & Smelting Co., 29,134 tons; Eagle-Picher Lead Co., 25,880 tons; Golden Rod Mining & Smelting Co., 19,570 tons; Commerce Mining & Royalty Co., 17,717 tons; St. Louis Smelting & Refining Co., 11,510 tons; Underwriters Land Co., 11,419 tons; Vinegar Hill Zinc Co., 11,380 tons; Skelton Lead & Zinc Co., 11,292 tons.

The Commerce Mining & Royalty Co. shipped more than 3,000 tons from its properties during the week ended May 30. One solid trainload of ore was shipped from its West Side mine, north of Picher, Okla.

E. H. Gibb, of New York City, is actively prospecting the Chapman lease, in the southern part of the Joplin-Miami district. He has five drill rigs operating, and the holes are being sunk deeper than any in the past. Heretofore drilling on the property has been limited to 200-ft. holes. Since this was done, however, adjoining properties have shown good ore runs down as deep as 350 ft., and it is to this depth that Gibb is making his investigation.

British Columbian Officials Will Build Roads to Mines

William Sloan, Minister of Mines for British Columbia, and W. H. Sutherland, Minister of Public Works, left Victoria on June 3 for the Portland Canal district, with a view to investigating the advisability of constructing a wagon road from the head of the Portland Canal to the new Cassiar gold diggings, which are attracting so much attention just now.

During the time he is in the district Mr. Sloan will visit the important mining districts, with a view to finding out their requirements in the way of roads and trails. A large amount of money has been invested in this district during the past winter, and the Minister feels that the province should contribute its share toward the development by making the properties readily accessible by the construction of good roads and trails.

Situation at the Mines

By Arthur B. Parsons
Assistant Editor

BAD CONDITIONS in the Lake Superior iron-mining region mar what otherwise would be a reasonably satisfactory situation in the metal-mining industry. Drastically curtailed operations in underground mines, and meager, if any, profits make iron mining "not so good." Strengthened markets for all the non-ferrous metals have helped producers materially. As indicated in the accompanying table, zinc has again reached the comfortable side of 7c. and lead is well over the 8c. mark, below which it sagged in May. Silver at 68.3c. is better than for three months, and copper at 13.36c. might be much worse.

Average Metal Prices

| Period | Copper | Lead | Zinc | Silver |
|------------------------|--------|-------|-------|--------|
| February..... | 14.463 | 9.428 | 7.480 | 68.472 |
| March..... | 14.004 | 8.914 | 7.319 | 67.808 |
| April..... | 13.252 | 8.005 | 6.985 | 66.899 |
| May..... | 13.347 | 7.985 | 6.951 | 67.580 |
| June (first week)..... | 13.360 | 8.435 | 7.050 | 68.300 |

Iron—Following the slack shipping season of 1924, stocks on hand at the Lake Superior iron mines at the beginning of the year were large, and with estimated shipments of only about 52,000,000 tons for this season, producers that have no long-time contracts are in a serious predicament. Several mines in both Michigan and Minnesota have been shut down during the last month. The most recent are the Leonard No. 1 and No. 2 mines of the M. A. Hanna Co. at Chisholm, where 200 men were laid off on June 1. The price of ore is 50c. less than in 1924 and 1.30c. under that of 1923, with no material reduction in costs, so that many of those who are shipping are losing 20c. to 40c. per ton. Excess potential mine capacity is the main difficulty. Two small companies in Michigan have cut wages 15 per cent, but it is not thought that this cut will become general, as the companies do not want to risk losing their best miners.

Copper—Mine production of copper apparently is being curtailed. The accompanying table shows the estimated difference between current rates and the maximum of the respective companies in recent months. Anaconda, if unofficial reports are true, cut to 20,000,000 lb. a month ago. Since then Calumet & Arizona directors have announced officially their intention of curtailing by 1,000,000 lb. at Bisbee and 500,000 at Ajo, where their subsidiary, New Cornelia, operates. The company produced 5,196,000 lb. at Douglas in April, but of this about 1,000,000 lb. was abnormal output coming from a special smelter clean-up. The United States S. R. & M. Co., at Kennett, Calif., is engaged in a final clean-up of its Mammoth smelter preparatory to permanent dismantling.

Granby Consolidated is preparing to resume production at the Allenby mine, in British Columbia, which it now controls. This should amount to about 1,500,000 lb. per month. Cerro de Pasco is producing 6,500,000 lb. in Peru, an increase of 2,000,000 lb. It is extremely unlikely that the net world production will be reduced by 16,000,000 lb. the sum of the figures given in the table. For one thing not all the companies were at their maximum during any one month; again, some of the reported reductions may not materialize, and some other producers may increase to offset cuts that are made.

Zinc—Production of zinc in the Joplin-Miami fields is at about 14,000 tons of concentrate weekly, considerably below capacity, which is at least 17,500. A windstorm that wrecked several tailings elevators caused a temporary suspension of a few plants, and the large producers are content not to push production. A new central power plant will serve the various mines and mills of the Commerce M. & R. Co., with a consequent reduction in operating costs. In the West, Anaconda has just announced that it will increase the capacity of its Great Falls electrolytic zinc plant from 15,000,000 to 20,000,000 lb. of zinc monthly. Anaconda's subsidiary, the International Smelting Co. has arranged to buy complex zinc ores in the Rico district, in Colorado, for shipment to Tooele, Utah, for concentration by selective flotation. A new and low freight rate goes into effect this month. Four companies in the Coeur d'Alene, the Sullivan (Star), Success, Highland Surprise, and Tamarack & Custer

are shipping zinc concentrates to Belgium by way of Pacific ports and the Panama Canal.

Lead—Lead mining is almost monotonously prosperous. In Colorado, the Leadville Deep Mines Co. has started shipping from the Graham Park Basin group, after an unwatering campaign lasting for more than a year. Production from the Tintic district, in Utah, increased considerably in May, whereas that of Park City declined somewhat. Seventeen producers contributed to the Tintic shipments. The International Smelting Co. has added to its large holdings in the Tintic district which it is to prospect through the Yankee shaft. The merger of the Park-Utah and Park City Mining & Smelting interests at Park City, just consummated, make a unit that can be economically operated. Utah-Apex, at Bingham, has developed new lead ore that makes its reserves the largest in its history. In southern California a leaching plant for lead-silver ores from Inyo County mines is nearing completion. By producing 16,684,000 lb. of lead in April the Consolidated M. & S. Co. established a new high record for its Sullivan mine in British Columbia.

Silver—Mine production of silver continues at the rate of about 5,000,000 oz. monthly in the United States and an equal amount in the rest of the world. Statistics for northern Ontario for the year to date show a small decline at Cobalt, which is offset by increases at South Lorrain. In the Frontier mine of the Mining Corporation the best oreshoot yet found in the district has been opened recently. Tonopah production is getting back to normal as the Tonopah Extension output increases. That company has put its big new Diesel electric power plant into operation. Curtailment by Anaconda at Butte will affect silver production, as Anaconda is the leading American producer.

Estimated Curtailment in Monthly Copper Production

| Company | Amount | Company | Amount |
|------------------------|-----------|-------------------|-----------|
| Anaconda..... | 3,500,000 | U. V. X..... | 1,000,000 |
| Chile..... | 2,500,000 | Miami..... | 1,000,000 |
| Phelps Dodge..... | 2,000,000 | Mammoth..... | 500,000 |
| Inspiration..... | 1,500,000 | New Cornelia..... | 500,000 |
| United Verde..... | 1,500,000 | Magma..... | 500,000 |
| Calumet & Arizona..... | 1,000,000 | Moctezuma..... | 500,000 |

Gold—Ontario's gold mines are flourishing as never before. The estimated output for May is \$2,600,000, which establishes a new high record. Hollinger, of course, Dome, McIntyre, and Lake Shore are the leading contributors. Remarkable results of development in the Rouyn district in northwestern Quebec seem to assure the construction of a smelter near the town of Rouyn, and a railway to the district. Noranda is the leader, but recently an excellent showing has been made at the Amulet property to the north of the Noranda. Whether this should be classed as a copper or a gold development is open to argument. A gross output of \$470,306 at Cripple Creek for May compares with \$326,735 in April. The Golden Cycle M. & R. Co. has announced a decrease of 50c. per ton in transportation and reduction charges, making a total of only \$2.50 on low-grade ores. This will help small operators and stimulate development and prospecting. The established producers in California, despite the burdens with which the economic situation saddle them, and the Homestake, in South Dakota, continue normal production. The Comstock Merger Mines Co. is slowly increasing the tonnage milled in the former United Comstock plant at Virginia City, Nev., though it is not yet near capacity. Gilbert, Nevada's gold "baby," has yet to cut its eye teeth.

Labor—The labor situation is causing no complaint. Curtailment in the iron-mining region has doubtless eased the "market" for Western producers.

Mexico—The federal officials in Mexico seem inclined to take a more liberal attitude toward mining enterprises than the state governments. They have effected a settlement of the Boleo strike and copper production has been resumed at Santa Rosalia. Also, federal authorities are acting as mediators in the controversy arising from the Guanajuato Reduction & Mines Co.'s decision to discontinue operations because of burdensome legislation. It is expected that operation will continue.

Societies, Addresses, and Reports

I.M.M. President Predicts Base Metals Famine

Sir Thomas Holland Discusses Relation of Physical Properties of Earth's Crust to Metal Resources

In his presidential address delivered before the Institution of Mining and Metallurgy in London recently, Sir Thomas Holland discussed the relation of the physical properties of the earth's outer shell to the metal resources available. Sir Thomas declared that the work of Clark and Washington, the results of which were published last year, has superseded all previous statistical results. The tables which were prepared bring out the high position occupied by elements which have hitherto been regarded as of rare occurrence and the comparatively low position held by the familiar base metals, especially zinc, copper, lead, and tin. Nickel, notwithstanding its relatively high price and low scale of production, is ten times as abundant as lead and one hundred times as abundant as tin. Washington assumes the existence of a central core of nickel iron.

"Adopting Clark and Washington figures," continued the president, "it is possible to state in tons the metal resources of the earth which are within accessible distance of the surface. Taking 50,000,000 square miles as the area of land containing accessible ores, and one mile as the average maximum working depth, it is obvious that with the present methods of mining and smelting, effective exhaustion will be reached before even one-millionth part of the accessible metals have been exploited.

The resources of coal and iron will easily outlast the reserves of zinc, copper, lead, and tin. A lead famine is in prospect. The optimism which places reliance on aluminum to remedy the shortage of other base metals is not well founded. Before there can be any justification for the substitution of other non-ferrous base metals by aluminum, metallurgical science will have to make an advance beyond anything which can be predicted.

"Civilization today depends on adequate supplies of base metals, so that every improvement in the treatment of ore adds to the actuarial value of civilized life. On the other hand, every increase in the cost of mining and metallurgical operations renders inaccessible some of the available reserves. As labor is the most important item in working costs, a trade union meeting can undo in a morning the results of a generation's research work in ore dressing and metallurgy."

South Africans Interested in Oil

A society is being organized with a view to fostering the development of the oil industry in South Africa, according to the Department of Commerce. Its organizers are mainly interested in oil-shale development, and one of its main objects will be to keep before the public the necessity for some form of local supplies of gasoline.

Mineral and Allied Industries of California Organize

As a result of the mineral conference held on May 15 and 16, 1925, at Los Angeles, by mineral producers of California, under the auspices of the California Development Association, a clearing house organization to be known as the Mineral and Allied Industries of California has been formed. The executive committee is as follows: Charles W. Merrill, chairman; Rush T. Sill, vice-chairman; Charles S. Knight, industrial director, secretary; R. D. Sangster, industrial manager Los Angeles Chamber of Commerce, vice-secretary. Two groups have been formed, one for northern and the other for southern California. C. E. Jarvis and John F. Davis are vice-presidents of the northern group and B. F. Hews is secretary. Industrial chairmen of northern sub-groups are as follows: Metallics, Robert I. Kerr; non-metallics, Lloyd L. Root; clay and brick, John T. Roberts; cement and gypsum, James A. Keller; crushed rock, sand and gravel, F. O. Hatch; machinery and equipment, E. O. Shreve. These chairmen each preside over five members constituting the committee in each sub-group.

The southern California group is in charge of Robert Linton and Edwin Higgins. Sub-group chairmen are as follows: Metallics, C. Colcock Jones; general non-metallics, C. W. Hill; clay and brick, Robert Linton; cement and brick, J. E. Jellick; crushed rock, sand and gravel, V. O. Johnson; machinery and equipment, Watt L. Moreland.

Tuolumne Society Meets

A meeting of the Tuolumne Mining Society was held at Sonora, Calif., on the evening of May 22. J. M. Hill, geologist in charge, San Francisco office, U. S. Geological Survey, addressed the newly formed organization on "Some Phases of the Mining Industry." His talk centered about the necessity of co-operative effort to revive quartz, drift and hydraulic gold mining. An especial appeal was made to the operators to assist the state mineralogist in his efforts to carry out the new "high-grade" law. The discussion that followed bore on the desirability of bridging the gap between the prospector and the capitalist.

Old Report on Cassiar District Still Available

Prospectors who are going into the Dease Lake area of the Cassiar District, British Columbia, this summer, will be pleased to know that copies of the report by Dr. G. M. Dawson can still be had. Although this report was written nearly forty years ago it contains much valuable information regarding the country and the placers worked in the early days. Copies may be obtained by applying to the Director, Geological Survey, Ottawa, or by writing to 510 Pacific Building, Vancouver, B. C.

Geological Institute of India Holds Annual Meeting

The proceedings of the annual meeting and dinner of the Mining and Geological Institute of India, held recently at Calcutta, were of more than usual interest. The large number of guests, the presence of Sir George Rainy, president of the Tariff Board and reference to controversial questions by some speakers were attractive features of the meeting.

In his presidential address, H. D. Coggan, the agent and general manager of the Central India Mining Co., Ltd., took an extremely interesting review of the Indian manganese industry from its very start. He was quite sure, that though no accurate estimates of the quantities of manganese ore available in India have been made, in the central provinces, which are the manganese storehouse of India and are responsible for about 85 per cent of the Indian production, the quantity of ore available runs into many millions of tons, which insures supplies for many hundreds of years. J. McGlasham, chief engineer, Calcutta Port Trust, explained some of the improvements that are being effected at the Calcutta docks to handle the coal trade and give it more facilities. He was inclined to blame the railway authorities for not sending coal in open wagons.

At the dinner the president referred to some of the recent labor legislation undertaken by the government of India and expressed misgivings regarding it. Sir George Rainy, who was present by special invitation, made a highly humorous speech detailing some of his interesting experiences as chairman of the Tariff Board. Sir Alexander Murray then proposed the toast, "The Mineral Industries of India," and made another interesting speech, but ended by complaining that even in the face of the fact that an Indian Coal Committee is now sitting and had recently visited Burma tenders to Burma of Indian coal and coke have been turned down, "for the sole reason, so we are informed, that Burma can get all the way from Scotland better value than from Bengal." Replying to the toast, Sir Willoughby Carey drew a more optimistic note by suggesting that the coal concerns of India should take a lesson from the jute mills and should pool their resources and take concerted action in the matter of regaining lost markets.

The government of India prize for the best paper accepted for publication during the year was awarded to Dr. C. S. Fox for his paper on "The Raw Materials of the Iron and Steel Industry in India." The Institute's silver medal was awarded to Dr. Penman for his paper on "The Coal Dust Danger in Indian Mines."

A Tucson Chamber of Mines

Declaring that mining is the country's foremost industry, paying nearly one-half its taxes, a group of mining men have organized a Chamber of Mines in Tucson, Ariz., with Miles M. Carpenter, a local engineer, at its head. It is proposed to stimulate legitimate mining and expose unscrupulous promotions.

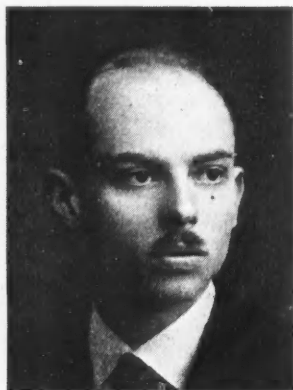
Men You Should Know About

Editorial Opportunity. It is likely that there may be an opening at once on the editorial staff of the *Mining Journal-Press*. Correspondence is invited, addressed to The Editor, *Engineering and Mining Journal-Press*, Tenth Ave. at 36th St., New York City.

E. A. Julian, general manager for the Goldfield Consolidated Mines Co., has been in Reno from San Francisco.

L. R. Robins, superintendent for the Tonopah Belmont Development Co. at Tonopah, is in Salt Lake City for a few weeks' vacation.

Felix E. Wormser, assistant editor of *Mining Journal-Press*, has resigned in order to engage in active mining work



Felix E. Wormser

as engineer for Colonel H. H. Armstead of New York. Colonel Armstead and Mr. Wormser have left for field examinations in Alaska and elsewhere.

W. L. Howe, of Blue Ridge Summit, Pa., has accepted the position of managing superintendent of the Lake Shore Stone Products Co., of Sandusky, Ohio.

P. Bosworth Smith, who has been in India almost continuously since 1885 on mining and geological business, latterly with John Taylor & Sons, has left India for good, and is returning to England.

J. L. Bruce during the first part of May examined the property of the Trinity Copper Corporation in Shasta County, California. He also made visits to some of the operating properties in the vicinity.

Jules Labarthe, metallurgical engineer, of San Francisco, has returned from Mexico City, where he had been on professional business.

Daniel H. Braymer has resigned as editorial director of *Industrial Engineer*, a McGraw-Hill publication, in order to devote the major part of his time to the activities of the recently organized D. H. Braymer Equipment Co., specializing in consulting and sales work associated with power applications in industrial plants, large buildings and

power plants, with headquarters in Omaha, Neb. He will retain his connection with the McGraw-Hill Co. as consulting editor of *Industrial Engineer*.

Professor Sir Edgeworth David, concerning whom some notes were published in this page on Oct. 25 last, has resigned the chair of geology and physical geography in the University of Sydney, Australia, and intends now to complete a work on the "Geology of Australia," on which he has been engaged for some time. At the date of his resignation at the end of December, the professor had completed thirty-three years of service with the Sydney University, which has conferred upon him the title of emeritus professor of geology.

Dr. L. A. Cotton, who had been for two years acting professor of geology in the University of Sydney, Australia, has been permanently appointed to that office, in succession to Professor David.

Arthur Wade, American geologist, now in the employ of the Australian Commonwealth reporting on oil possibilities, in December last visited the Roma district of Queensland, where oil prospecting has been in progress for several years. He was afterward to inspect other regions in this northern state of Australia.

M. J. Cunningham, president of the Bank of Bisbee, has been elected president of the Wolverine Mining Co., of Bisbee, and **Frank C. Brophy**, of Phoenix, has been elected vice-president, with **J. M. Ball** and **Hugh Dugan**, of Bisbee, treasurer and secretary, respectively. **James E. McKenna**, formerly superintendent of the Night Hawk Leasing Co., was made superintendent.

Anglo-American Service Corporation, S. A., has been organized by a number of engineers in Mexico, with the purpose of acting as intermediary in the technical study of enterprises established in that country and to contribute to the development of its natural resources. Its services are available to American capitalists having or wishing to acquire interests there. Its office address is Calle de Nuevo Mexico No. 6. F. A. Lilliendahl is the president and among the consulting personnel are the following mining engineers: Louis C. Espinosa, John A. Thomson, Faustino Roel, and Amadeo Larralde.

Obituary

S. C. Lowe, gas and petroleum engineer, of Houston, Tex., died in that city on June 1, after an attack of heart trouble. Mr. Lowe's father, Prof. T. C. S. Lowe, was the builder of the railway to the top of Mt. Lowe, California.

William D. Gibson, for twenty-five years engaged in the Butte, Mont., district as shift boss, independent leaser, mining superintendent, and manager of mining properties, died recently. Mr. Gibson was looked upon

as an authority on the vein system and underground workings of the Butte district and his opinion of mining properties was valued greatly by investors.

Dr. John Mason Clarke, state geologist and paleontologist of New York, whose death in Albany on May 29 was chronicled in these columns last week, was for many years the leading invertebrate paleontologist and geologist of America. Although his activities covered a wide range of subjects, his chief interest was manifested in bird protection; ceramics; history, composition, evolution, and migration of Paleozoic faunas; origin, classification, and cartography of Paleozoic rocks; structure of Paleozoic organisms; and geologic history of parasitism. As director of the state museum Dr. Clarke made extensive studies of the late glacial



Photo by Bachrach
Dr. John M. Clarke

deposits. Born in Canandaigua, N. Y., April 15, 1857, he was graduated from Amherst with the class of 1877. Later he received degrees from various universities as follows: A.M. from Amherst and Göttingen; Ph.D. from Marburg; LL.D. from Amherst and Johns Hopkins; and Sc.D. from Colgate, Chicago, and Princeton. He was beloved by every one who knew him, and his death was a great shock to a worldwide circle of friends and co-workers. Dr. George F. Kunz, long an intimate friend of Dr. Clarke, pays this tribute:

"Dr. Clarke was one of America's pre-eminent geologists. He not only achieved pre-eminence in his own field of science but he became equally prominent in the literary world. His highly interesting life of James Hall is in reality a masterly exposition of the history of geology in the United States. In his later years his mind turned more to the philosophical side of geology and paleontology and his contributions along this line were, as were all of his writings, masterpieces of literary excellence and scientific worth. His long training in the observation and lucid expression of facts gave him the proper background for his philosophic studies and broadened his vision so that he was prepared to recognize the general underlying principles of scientific research and human philosophy."

Recent Technical Publications

Reviews, Abstracts, and References

How Metals and Minerals Are Sold

The Marketing of Metals and Minerals.
Edited by Josiah Edward Spurr and
Felix Edgar Wormser. McGraw-Hill
Book Co., Inc., New York. Price \$6.

In Hoover's "American Individualism" runs the thought, "The only road to further advance in the standard of living is by greater invention, greater elimination of waste, greater production and better distribution of commodities and services." That the study of the science of selling has been woefully neglected in two of the world's primary industries—farming and mining—is a statement that will hardly be challenged. What constructive thinking has been given the matter has been applied during the last few years. This "Marketing of Metals and Minerals" is a veritable broadside into the selling end of the mining business.

So far as the literature is concerned, it breaks new ground. Nothing but scattered fragments of information have been published on the subject; the fifty contributors who have co-operated in this effort have done a real job. Forty practical traders and distributors of mineral products, together with ten experienced analysts whose contacts qualify them to speak with responsibility, discuss the marketing methods and conditions for each of some ninety minerals and metals. The thing that impresses most about the job is the completeness of background presented. Distribution and methods of selling are thrown into relief by a line-up of the world situation in each mineral. The book does not examine into the financial control of the raw materials included, but it does, by ample reference to localities of production and marketing, indicate the political control.

The arrangement of contents into three parts places the Marketing of Metals and Ores in Part I, the Marketing of Non-Metallic Minerals in Part II, and three important articles of a general nature in Part III. The last eighteen of the 674 pages of the book carry a particularly complete treatment of a phase of the American metal market that is perennially up for discussion—the case for and against the Metal Exchange. The activity and influence of the great London Metal Exchange is analyzed by one of its members, and the possibilities of broadening the scope of the present New York Metal Exchange are fairly set forth by Felix E. Wormser of the *Engineering and Mining Journal-Press*, speaking for a long list of producers and consumers vitally interested in the metal market. The question seems rather positively disposed of—in the negative to date—by the fundamental intent of the American metal producer to deal only with the consumer. Whether there is still a chapter to be chronicled on this remains to be seen. The writer of this review, an individual who has had, for a considerable period just passed, a particu-

larly close and intimate opportunity to analyze the factors and forces that are at play in the New York metal market, has another view.

Another article that warrants mention is the analysis of the commerce in metalliferous ores and concentrates. This is one of the most worth-while sections of the book, intelligently handled; it covers a subject more or less difficultly understood by sellers. In passing, it is to be observed, however, that the remark under the caption "Settlement Sheets" that "the purpose, it would seem, is to show the seller why he gets so little" is gratuitous, and not entirely in keeping with the requirements of the situation.

There are few errors indeed in the information assembled in this volume. A critic likes to shoot a thing full of holes. This time it simply can't be done; the sixty-four articles have drawn more or less fire from the trade during the past eighteen months as they have come out one by one in the *Journal-Press*; and about all that can be done in the shoot-'em-up line is to observe that the editors have had their ears to the ground. Some improvements exist over certain of the first appearances of the various sections and all the data have been brought strictly up to date. I have an idea that the second edition will differ from this first one at very few points. What changes there are will be in the addition of certain phases of marketing among the less standardized minerals, rather than in any great number of corrections of presented data. Certain raw materials, as for example silica, mica, asbestos, are used in so many different forms and industries that producers and consumers of one type are not always conversant with all the others. An important addition to the article on Lump and Ground Silica, already published in the *Journal-Press* issue of April 18 from the pen of Raymond B. Ladoo, brings out this fact, in the statement that instead of having the moderate industrial application indicated in Wormser's article, pulverized silica is a branch of the industry that runs into fair-sized figures—364,000 short tons consumed in 1923, valued at about \$3,000,000. Also, although not mentioned in the original article as a source of pulverized silica, ground sand and sandstone to the amount of about 250,000 tons, valued at \$1,673,000, actually figured as a source of first importance in 1923.

In the Potash article, we read that "unless the German and French producers reach an agreement," potash requirements of the fertilizer industry seem assured at a comparatively low price. Although it is true that developments in the chemical industries are so rapid these days that it is hard to bring articles thereon strictly up to date, it would seem fairly safe to have announced that there has been, since the summer of 1924, a positive agreement on prices and market quotas between the two interests mentioned. So far, the producers seem to continue to ob-

serve their announced policy of trying to expand the demand and develop the enormous consumption possibilities of America for potash.

It occurs to me that a volume of this sort will be useful to the manufacturers of mining and power machinery as well as to the producer of metals. There are, all over the land, deposits of minerals for which geology, mining engineering, and metallurgy have readily enough prescribed flow sheets and equipment for owners who find themselves without knowledge of where or how they can market their product. Machinery houses not infrequently have inquiries from producers of this sort, desirous of going ahead provided they can round out their picture. For a lot of pioneers and operators in this predicament, "The Marketing of Metals and Minerals" will be good medicine.

The complete extent of its usefulness, however, can hardly yet be appraised. It is to my knowledge keenly welcomed by the trades themselves, and two leading mining schools have taken it on as a text-book for class work. The subject matter was clearly in need of treatment, and I have an idea that this book will take its place as one of the most worth-while efforts the mining world has enjoyed.

ROWE PURCELL.

Butters Filters—In the *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa for February appears a 9-page illustrated article by A. Hay Davidson entitled "Improvements in Mechanical Apparatus Relating to the Butters Filter Plant." (Price 3s. 6d.; Johannesburg.) There are 9,600 Butters filter leaves in use on the Rand and in Rhodesia, every new mill having adopted this device for slime filtration, so that, naturally, numerous improvements have been made.

Patents

Concentrator—No. 1,536,173. May 5, 1925. E. J. Webb, Chisholm, Minn. A circular inverted dish-shaped table adapted for ore concentration, the pulp being fed at the center of rotation.

No. 1,536,236. May 5, 1925. W. R. Morris, Boise, Idaho, assignor to Mineral Development Co., Boise. A mechanically agitated box of special design for separating or classifying particles of different characteristics.

No. 1,537,424. May 12, 1925. W. G. Elms, Oakland, Calif. A concentrator of the gravity classifier type, the pulp flowing downward in a cylindrical inner chamber, depositing a part of its load at the bottom, and ascending in an outer cylinder from which it is discharged at the top.

Amalgamation—No. 1,536,375. May 5, 1925. May Krump Coddling, San Francisco. Apparatus for amalgamating ores.

No. 1,537,215. May 12, 1925. L. W. Austin, San Jose, Calif., assignor of one-half to P. W. Lee, Sacramento. An amalgam for recovering the valuable metals from ores, consisting of sodium, zinc, and mercury, the sodium not exceeding 10 per cent of the weight of the mercury, and the zinc not exceeding 15 per cent of the weight of the mercury.

New Machinery and Inventions

A Dipper Front of New Design

A very rugged dipper front, known as the Clark bridge-type, has been developed by the American Manganese Steel Co. The bottom has a double wall supported by connecting ribs, which in turn form sockets for teeth, thus doubling the strength of the dipper lip. The ribs are so arranged that the front may be equipped with the number of teeth that will give the most efficient digging results. For example a 2½-yd. front has nine sockets, and the operator may use either three, four, five or nine teeth, depending on the kind of material to be dug and the particular features of the operation.

The construction just described results in a cutting edge arranged with a number of square tooth-pockets into which are placed, alternately, digging teeth made of square tool steel bars and pick-up teeth made of Amsco cast manganese steel. There is also provided under the teeth a small renewable wearing band on the outside of the cutting edge.

The number and length of the tool-steel digging teeth may be readily changed according to conditions and they are quickly removed and resharpened, since no bolts or other locking devices are necessary. This feature is of particular advantage on digging jobs which require sharp chisel-point teeth to obtain the requisite yardage. After the teeth become worn, they may be brought forward by placing small blocks in the bottoms of the pockets holding the teeth, thus giving them the desired digging length. When the teeth are placed in the sockets, they are always in the same plane, thus allowing an even distribution of shock and wear over all the teeth.

The front is made perfectly flat and has the ability of making a smooth, even cut, which is so desirable in stripping or digging coal with power shovels, or digging slag. This flat bottom is so reinforced that buckling is impossible, and the digging edge is very strong due to having an integral inside and outside wall joined together by numerous braces, forming, as the name implies, the bridge-type front.

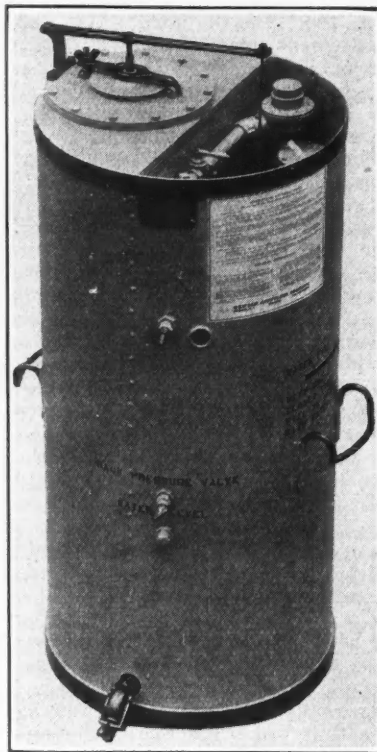
In addition to the features peculiar to the design of this new front, the metal of which it is made is manganese steel.

Portable Acetylene Generator

A small generator for producing acetylene at low pressure for welding and cutting has recently been developed. It takes 35 lb. of carbide at one charge and can be transported readily from place to place, thus providing a portable supply of generated acetylene gas. Empty, it weighs only 210 lb.

The makers say they have developed a new principle of feed control which might be called a "heavier-than-water" float. A vertical partition, extending nearly to the bottom into a water seal, divides the generator shell. One side is gas tight and contains the carbide

hopper at the top. The upper part of the other side contains gas-regulating and protective devices, and an automatic carbide feed control. Generation of the first acetylene causes water to rise on this side of the partition high enough to all but submerge a pan full of water, hung to a control lever. This pan normally acts as a weight acting counter to a spring, but as the water rises about it, its apparent weight is diminished and the carbide hopper



A new principle of feed control has been embodied in this portable acetylene generator

valve is closed by the action of the spring. As acetylene is drawn off, water rises in the gas compartment and correspondingly lowers under the float, relieves some of the buoyancy under the water pan, which, gathering weight with the receding water, depresses the spring and allows a small amount of carbide to drop into the generator, and restore equilibrium conditions.

Because of its low center of gravity, the generator rights itself when tilted at an angle of 30 deg. It works perfectly, it is claimed, at an inclination of upward of 10 deg. No adverse effects result if a generator while in operation is knocked over. Nearly all fittings are inclosed in the cylindrical shell, and there is little, if anything, projecting which may be injured by a fall on a concrete pavement.

This generator has been submitted to the Underwriters' Laboratories, Inc., and has been listed by them as an acceptable device for installation on insured premises. It is made by the Oxweld Acetylene Co., 30 East 42d St., New York.

New Alloy Steel Rivet Set Introduced

A rivet set for pneumatic hammers, which, it is claimed, will last longer than a set usually lasts, is being made by the Ingersoll-Rand Co., 11 Broadway, New York. Economy is claimed for it because of the greater number of rivets driven per set and the avoidance of delays due to breakage. This new set is called the "Jackset." It is made of a high-quality alloy steel, which will stand a much greater degree of heat from hot rivets, without the temper becoming drawn. It is specially forged and then heat-treated by a new process. This new set is the result of long experience in building rivet sets and of hundreds of tests on different steels and heat treatments, made in an effort to produce a tool better able to withstand the stresses of riveting service than the ordinary carbon-steel rivet set.

Flotation Reagents to Be Tested and Developed at This Plant

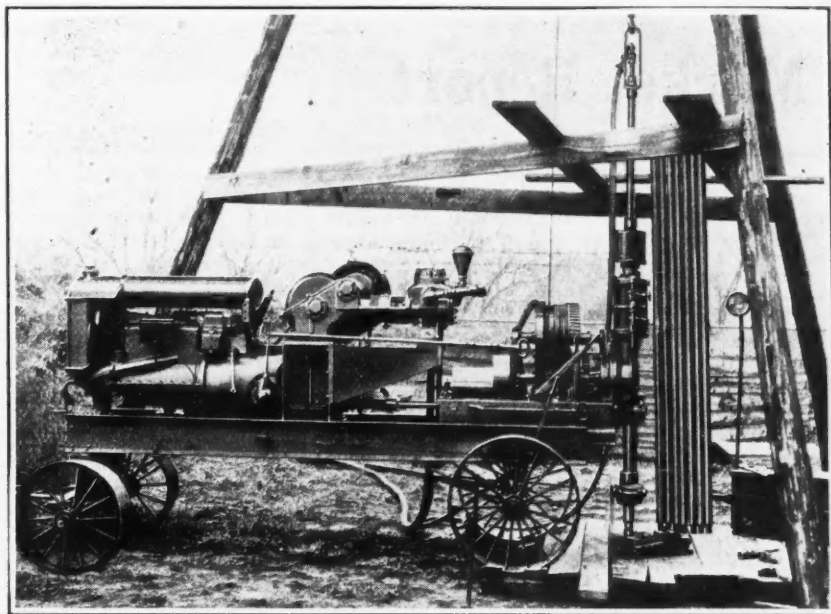
The Newport Chemical Works, Inc., of Passaic, N. J., is establishing a complete and up-to-date experimental station in connection with its extensive laboratories at that point. The station will be thoroughly equipped with various types of ore-manipulating machinery and in addition there will be a complete metallurgical laboratory. J. C. Williams, for several years superintendent of the experimental plant of the Colorado School of Mines, has been added to the Newport forces to direct the work of the station. In addition to his collegiate connections Mr. Williams has a thorough knowledge of the subject and has had extensive experience throughout the Western mining fields. The company is one of the largest producers of wood and coal-tar products and is the sole manufacturer of XY mixture and G N S pine oil as well as one of the principal suppliers of T T mixture. The object of the station that is being established will be to develop and test flotation reagents in a practical way.

Portable Diamond Drill Powered With Ford Engine

The accompanying photograph shows the Sullivan mounted diamond drill, with Ford engine power plant, using kerosene as fuel. This outfit is made in two sizes, the "CN" having a capacity of 1,000 ft. and 2-in. core, and the same rig with the company's standard "C" diamond drill, removing a 1½-in. core to a depth of 2,000 ft.

The drill with gas-engine drive is mounted on one end of a substantial steel truck equipped with large-diameter wide-face steel wheels. At the other end of the truck is mounted the engine from a Fordson tractor, forming a power plant which operates the drill through a telescopic shaft in the bed of the truck.

The third member of the unit is a duplex double-acting high-pressure pump which is used to supply wash water to the drill hole, and for the hydraulic cylinders.



Portable diamond drill with Ford engine power plant using kerosene as fuel

The drill is the standard Sullivan CN machine with single hydraulic cylinder, and fittings which bore a hole $2\frac{1}{8}$ in. in diameter, and which removes a 2-in. core.

The outfit can be hauled by a tractor or a team of horses over country roads or rough territory. The absence of a steam boiler cuts down the supply of water required one-third at least. This is an important factor in countries where water must be hauled a considerable distance to the machine.

The third element, that of fuel, is also an important factor. The Ford engine starts on gasoline, but runs on kerosene.

Trade Catalogs

Driers. Ruggles-Coles driers, in eight different types are briefly described in a 4-page folder that has been issued by the Ruggles-Coles Engineering Co., York, Pa.

Diesel Engines. Bulletin No. 1031, of Fairbanks, Morse & Co., Chicago, Ill., describes the operation and construction of Fairbanks-Morse Type Y Diesel engines. 32 pages.

Diesel Engines. Bulletin 808, entitled "The Type J Fulton-Diesel," issued by Fulton Iron Works Co., St. Louis, Mo., includes a diagram of the engine and a table of principal dimensions for the several sizes.

Electric Crane—Morgan Type B crane trolley with worm drives and roller bearings is described in a 4-page folder issued by the Morgan Engineering Co., Alliance, Ohio.

Gas Burners. Two circulars describing the "Hunter" natural-gas burners for use in oil and gas fields have been received from the manufacturer, Nimrod, Ltd., 6 Broad Street Place, London, E.C. 2, England.

Arc Welding. A résumé of the uses and value of automatic arc welding, with a description of the welding apparatus and generating equipment used, is given in a bulletin bearing the num-

ber 48937.1 and entitled "Automatic Arc Welding," recently issued by the General Electric Co. This is a 20-page, paper-bound booklet.

Carbide Lights. The Milburn light, for contractors, railways, mines and quarries, is described in a small 24-page catalog of the Alexander Milburn Co., 1416 West Baltimore St., Baltimore, Md.

Welding. Milburn welding and cutting apparatus is described in a 24-page catalog of the Alexander Milburn Co., 1416 West Baltimore St., Baltimore, Md.

Boiler and Furnace—Construction Engineering Corporation, New York City, has issued a booklet, "Report of Evaporative Tests on Boiler No. 1, Power House No. 1, River Rouge Plant of the Ford Motor Co." The book shows the equipment used in the test and gives the data of eleven separate tests.

Screens.—A new book descriptive of "Clean Water" intake screens has been published by the Link-Belt Co., Indianapolis, Chicago or Philadelphia. More than thirty views of various installations are included. Copies of this book (No. 752) will be mailed free upon request.

Special Machinery. The Dodge Manufacturing Corporation, Mishawaka, Ind., has just released an elaborate book visualizing the engineering, foundry and machine shop facilities of that company available for the manufacture of special machinery and equipment. The book also shows a wide range of special equipment built by the company. A copy of this book will be sent to executives of engineering and sales companies, as well as manufacturers who prefer not to build their own special machinery, but to use their plant equipment for the manufacture of their standard products.

Plate Valves. The Mesta Machine Co., Pittsburgh, Pa., has just published a new bulletin (Bulletin "D") on the subject of Mesta automatic plate valves

(Iversen patent). It contains 16 pp., illustrated.

Conveyor Idlers. Mellin belt conveyor idlers, made by the Hydraulic Pressed Steel Co., Cleveland, Ohio, are described in a new well-illustrated catalog, which includes 34 pages of engineering data.

Packing. A very handsome publication of 176 pages is the new A-1925 general catalog just issued by the Garlock Packing Co., Palmyra, N. Y., featuring Garlock "packing service." It contains tables of engineering data, numerous diagrams showing methods of using packing, and much other information on the subject.

Pulverizers. Catalog No. 16 of Raymond Bros. Impact Pulverizer Co., Chicago, Ill., covers grinding, pulverizing and separating machinery. It contains 62 pages, illustrated.

Coal Pulverizing. "Rayco Pulverized Coal Systems" is the title of a catalog on modern firing methods using powdered coal, distributed by Raymond Bros. Engineering Co., 1315 North Branch St., Chicago, Ill.

A Handbook on Superheated Steam

Superheat Engineering Data—A handbook on the generation and use of superheated steam. Sixth edition, revised. (Superseding Data Book for Engineers.) The Superheater Co., New York and Chicago, 1925. Bound in keratol, $4\frac{1}{2} \times 7$ in., 208 pages, 85 illustrations and diagrams, 69 tables. Price \$1.00.

This handbook contains condensed data for steam power plant engineers and operators. A feature of the book is the index consisting of 16 pp., assuring ready reference. Superheated steam, its advantages over saturated steam, and the proper design and performance of superheaters, are briefly discussed. It illustrates superheater arrangements in practically all stationary, marine, and locomotive type boilers commonly made in America. Waste heat, portable, and separately fired superheaters are also shown. Brief comparative data are given as to sizes, tube sizes, arrangement of tubes, etc., for the stationary water tube boilers illustrated. The steam tables cover pressures from below atmospheric to 600 lb., absolute, and include properties of superheated steam from 50 to 300 deg. F. superheat.

The section on piping includes information for figuring piping for handling water, saturated and superheated steam, and velocity and pressure drop of water and steam flowing through piping. In this section are included also the proposed American standards for high pressures. "Superheat Engineering Data" also contains engineering data on coal- and oil-fired boilers, which include tables of heat values for gaseous, liquid, and solid fuels. Other miscellaneous data include complete conversion tables and data on bolts and screw threads, with the recent work of the American Engineering Standards Committee and the National Screw Thread Commission. There are also many miscellaneous tables frequently used by steam engineers.

The Market Report

Daily Prices of Metals

| June | Copper N. Y. net refinery* | Tin | | Lead | | Zinc |
|------|----------------------------|-------------|---------|-------|-----------|------------|
| | Electrolytic | 99 Per Cent | Straits | N. Y. | St. L. | St. L. |
| 4 | 13.375 | 54.375 | 55.375 | 8.425 | 8.00@8.35 | 7.00@7.05 |
| 5 | 13.35 | 55.125 | 56.25 | 8.425 | 8.00@8.35 | 7.05 |
| 6 | 13.35 | 55.125 | 56.25 | 8.425 | 8.00@8.35 | 7.00@7.05 |
| 8 | 13.35 | 54.75 | 55.75 | 8.425 | 8.275 | 7.00 |
| 9 | 13.25 | 54.375 | 55.50 | 8.40 | 8.25 | 6.975 |
| 10 | 13.25 | 54.50 | 55.50 | 8.40 | 8.15@8.20 | 6.975@7.00 |
| Av. | 13.321 | 54.708 | 55.771 | 8.417 | 8.204 | 7.010 |

*The prices correspond to the following quotations for copper delivered: June 4th, 13.625c.; 5th, 6th and 8th, 13.60c.; 9th and 10th, 13.50c.

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

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

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

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

London

| June | Copper | | | Tin | | Lead | | Zinc | |
|------|--------------------------------|--------------------------------|--------------------------------|---------------------------------|---------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| | Standard | | Electrolytic | Spot | 3M | Spot | 3M | Spot | 3M |
| | Spot | 3M | | | | | | | |
| 4 | 59 ⁷ / ₈ | 60 ⁷ / ₈ | 63 ¹ / ₂ | 251 ¹ / ₂ | 252 ¹ / ₂ | 33 ³ / ₈ | 33 ³ / ₈ | 34 | 33 ³ / ₈ |
| 5 | 59 ⁷ / ₈ | 60 ⁷ / ₈ | 63 ¹ / ₄ | 255 ¹ / ₂ | 256 | 34 | 33 ³ / ₈ | 34 ¹ / ₂ | 33 ³ / ₈ |
| 8 | 59 ⁷ / ₈ | 60 ⁷ / ₈ | 63 | 254 ¹ / ₂ | 255 ¹ / ₂ | 34 ¹ / ₂ | 33 ¹ / ₈ | 34 ¹ / ₂ | 33 ³ / ₈ |
| 9 | 59 ¹ / ₂ | 60 ¹ / ₂ | 62 ¹ / ₂ | 253 ³ / ₈ | 254 ³ / ₈ | 33 ¹ / ₂ | 33 ¹ / ₈ | 33 ¹ / ₈ | 33 ¹ / ₈ |
| 10 | 59 ³ / ₈ | 60 ³ / ₈ | 62 ¹ / ₂ | 253 ³ / ₈ | 254 ³ / ₈ | 33 ¹ / ₂ | 33 ¹ / ₈ | 34 ¹ / ₂ | 33 ¹ / ₈ |

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

| June | Sterling Exchange "Checks" | Silver | | | June | Sterling Exchange "Checks" | Silver | | | Gold London |
|------|----------------------------------|--------------------------------|--------------------------------|--------------------------------------|------|----------------------------------|--------------------------------|---------------------------------|--------------------------------------|-------------|
| | | New York | London | Gold London | | | New York | London | | |
| 4 | 4.85 ¹ / ₂ | 68 ¹ / ₂ | 31 ¹ / ₂ | 84s 11 ¹ / ₂ d | 8 | 4.85 ³ / ₈ | 68 ³ / ₈ | 31 ³ / ₈ | 84s 11 ¹ / ₂ d | |
| 5 | 4.85 ¹ / ₂ | 68 ¹ / ₈ | 31 ³ / ₈ | 84s 11 ¹ / ₂ d | 9 | 4.85 ¹ / ₂ | 68 ¹ / ₂ | 31 ⁹ / ₁₆ | 84s 11 ¹ / ₂ d | |
| 6 | 4.85 ¹ / ₂ | 68 ¹ / ₂ | 31 ³ / ₈ | ..... | 10 | 4.85 ¹ / ₂ | 68 ³ / ₈ | 31 ¹ / ₈ | 84s 11 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-quarter of a cent premium.

Metal Prices Vary Only Slightly in Quiet Market

New York, June 10, 1925—None of the non-ferrous metals have had an active market in the week ending today. Prices have been generally steady, however, and tin is even higher than last week despite the small volume of business. Copper and lead are slightly lower, and zinc is back to the level of a week ago, after again going above 7c. during the week, owing to export demand.

Copper Freely Offered at 13¹/₂c.

The copper market has declined somewhat from the 13³/₈c. delivered level of a week or so ago. Several producers

are still holding at that figure, but admit that the quotation is only nominal and that good tonnages have been available at 13¹/₂c. during the last two days. In fact, some large consumers could have bought at 13¹/₂c. late Monday afternoon. Whether or not all producers will revise their quotations downward remains to be seen. So far, business has not been as good at 13¹/₂c. as it was at 13³/₈c. The total volume of sales has been about the same as recently.

The decline has been caused by lower offerings abroad. Producers are accusing foreign dealers of cutting prices,

whereas the dealers say they would not have had to cut prices had producers maintained in all instances their former level of around 13.75c., c.i.f. The facts seem to be that most of the producers' agencies have firmly held around 13.75c., but that one or two agencies have cut down to 13.65 and 13.60c., c.i.f., which has brought out offers from certain dealers at as low as 13.55c.

Fundamental conditions in the copper industry continue good. Production has been cut down somewhat, foreign business has been good, and stocks are not unduly large. In fact, it is an open secret that stocks of refined copper have decreased about 25,000 tons in the two-month period from April 1 to June 1. Large shipments for export have no doubt been the principal factor in this reduction. Some increase may have occurred in warehouse stocks abroad, but it probably does not exceed 5,000 tons. Copper prices have withstood the effect of a quiet market for almost two months now, so it would not seem that at this late day any marked decline is to be expected.

Premium Prices on Lead Disappear

The contract price for lead set by the American Smelting & Refining Co. continues at 8.40c., New York. Until the last two or three days, other sellers were able to get more than this, 8⁵/₈c. having been done in the New York district for shipment from the West, at least up to Monday. Sales of several hundred tons were made between that level and 8.45c., but in the last two days lead has been so freely offered for any shipment, from spot to July, at the 8.40c. quotation that premium prices have become only nominal or where special brands are desired. Inquiries and sales have been in much more moderate volume, the stampede for lead having entirely vanished. Most buyers want June shipment, there being so far little demand for July.

The market in the Middle West has been more quiet than in the East. The principal producer continued to make sales on Thursday and Friday on the basis of one-third of the desired tonnage at 8c. and the remainder at the average, but this way of marketing the metal seems no longer to be attractive to purchasers. The average price obtained for lead sold in the last three days, therefore, has been that of the open market. There was a strong urge to sell lead from some directions yesterday, and quotations as low as 8.175c., St. Louis, were made. Today even this might be shaded.

As is to be expected, production has increased with the turn of the market downward, and sellers have also found that they had a little more lead than they were willing to admit before. A rather steady market is expected, for consumption is keeping up well, and

furthermore, there is every indication that producers will lay in modest stocks before prices go as low as they did in April.

Export Demand Aids Zinc

The price of zinc again went above 7c. last Thursday, owing to advances in the foreign market, though it has again broken through that level in the last two days. Domestic consumers have been almost entirely out of the market, especially galvanizers, though a few round lots of brass special have been sold at 10 to 15 points premium over Prime Western. The statistics of the American Zinc Institute show an average daily production almost exactly the same as in April. Foreign shipments were also practically the same, but domestic shipments were slightly less, so that the stocks increased by about 3,000 tons, though they are equal to only two weeks' consumption.

| | |
|-----------------------------------|--------|
| Stock, May 1..... | 18,337 |
| Produced | 49,738 |
| | 68,075 |
| Shipped | 46,865 |
| Stock, May 31..... | 21,210 |
| Shipped from plant for export.... | 5,888 |
| Stored for customers | 67 |
| Retorts operating, May 31..... | 86,457 |

High-grade zinc continues at 8½@8¾c.

Tin Strong in London

The strength in tin continues to be inspired by London, where pool buying is said to have supported the market. Buyers here have been scarce, and often the metal has been offered below import cost. Chinese tin has sold as much as 1¼c. below the price of Straits, with the better English grades of 99 per cent about ¼c. above Chinese. Forward prices have ruled the same as spot.

Recovery Follows Break in Silver

Following the continued advance of the past two weeks, a reaction in silver occurred with a sharp break in prices of ¾c. in two days. The setback was short lived, however, for it recovered promptly to the higher prices and appears steady at this level. China continues the principal factor in maintaining the market.

Mexican Dollars: June 4th, 52½c.; 5th, 52¾c.; 6th, 52¾c.; 8th, 52¾c.; 9th, 52¾c.; 10th, 52¾c.

French Exchange Unsettled

Francs were very heavy during the week, going well below 5c., but strengthened on the report that the Morgan credit would be used to support the market. The U. S. Post Office decreased the exchange value of the franc from 6c. to 5c. On Tuesday, June 9, closing cable quotations on francs were 4.95c.; lire, 3.98c.; and marks, 23.81c. Canadian dollars continued at par.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, £118.

Antimony—

Chinese brands, 16½@16¾c. per lb. Cookson's "C" grade, 18¾c.

Chinese needle, lump, nominal, 10c. Standard powdered needle, 200 mesh, 11½@13c.

White oxide, Chinese, 99 per cent Sb₂O₃, 16@18c.

Bismuth—\$2 per lb., in ton lots. London, 7s. 6d.

Cadmium—60c. per lb.

Iridium—\$375@£400 per oz. London £70.

Nickel—Ingot, 31c.; shot, 32c.; electrolytic, 38c.; London, £170@£175 per long ton.

Palladium—\$79@£83 per oz. Crude, \$60. London £16.

Platinum—\$120 per oz. refined. London, £25 per oz. Market quiet and it is difficult to get full prices.

Crude, \$115.

Quicksilver—\$83 per 75-lb. flask. San Francisco wires \$82. Quiet. London £13¾.

The prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmiridium, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the prices given in the June 6 issue.

Metallic Ores

Tungsten Ore—Per unit, N. Y.:

High-grade wolframite \$11@£11.50 per unit. Ordinary quality, \$11. Scarce.

High-grade Western scheelite. \$11.50 nominal.

Chrome, Galena Radio Crystals, Iron Ore, Manganese, Molybdenum, Tantalum, and Vanadium Ores are unchanged from June 6 quotations.

Zinc Lower—Lead Unchanged

Joplin, Mo., June 5, 1925

| Zinc Blende | Per Ton |
|---------------------------------------|-------------------|
| High | \$54.15 |
| Premium, basis 60 per cent zinc | \$51.00 @ \$53.00 |
| Prime Western, 60 per cent zinc | \$49.50 @ \$48.50 |
| Fines and slimes..... | \$48.00 @ \$45.0 |
| Average settling price, all. | \$46.73 |

Lead Ore

| | |
|------------------------------|----------|
| High | \$113.30 |
| Basis, 80 per cent lead.... | \$110.00 |
| Average settling price, all. | \$96.00 |

Shipments for the week: Blende, 15,648; lead, 1,908 tons. Value, all ores the week, \$909,340.

Buyers in Joplin today report offerings of only \$48.50 Prime Western, but a telephone message from Miami reports offerings of \$49 and \$49.50 basis at 6 o'clock this evening.

A heavy storm at Waco swept away tailing elevators at several mines, causing slight restriction of output.

The third thousand tons is reported purchased for export today, and about 1,800 tons has been loaded out.

Platteville, Wis., June 6, 1925

| Zinc Blende | Per Ton |
|-------------------------------------|---------|
| Blende, basis 60 per cent zinc..... | \$51.50 |

Lead Ore

| | |
|-----------------------------------|----------|
| Lead, basis 80 per cent lead..... | \$115.00 |
|-----------------------------------|----------|

Shipments for the week: Blende, 735 tons; lead, 30 tons. Shipments for the year: Blende, 20,536; lead, 837 tons. Shipments for the week to separating plants, 1,107 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Beryl, Borax, Celestite, Chalk, China Clay, Corundum, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilonite, Graphite, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Ozo-cerite, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from June 6 prices.

Mineral Products

Arsenious Oxide (White arsenic)—5c. per lb.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and Zinc Oxide are unchanged from June 6 prices.

Ferro-Alloys

Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferrouanium and Ferrovanadium are unchanged from the prices given in the June 6 issue.

Metal Products

Copper Sheets—Base price 21.75c. Wire, 15.875c.

Nickel Silver, Yellow Metal, Zinc Sheets and Lead Sheets are unchanged from the issue of June 6.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick, and Zirkite are unchanged from June 6 prices.

Steel Output Steady

Pittsburgh, June 9, 1925

There has been little change in the volume of steel buying since late in April, and but little decrease in steel mill operations since early in May. Steel buying is at 50 to 55 per cent of capacity, production and shipments being at fully 65 per cent, the difference being made up of old orders, for rails, etc., practically all the current buying being for prompt shipment.

With the approach of midsummer conditions have not grown worse to the extent expected, hence the outlook is considered better. Consumption is at a very good rate, being made up of shipments plus liquidation of stocks, and there is at present little prospect of diminution in the next few months.

Pig Iron—The third decline in Valley foundry iron in less than a month has just occurred, the market going off 50c. on purchases of 30,000 tons for second half by the Standard Sanitary Manufacturing Co. on the basis of \$18. Basic and bessemer, inactive, are carried down, as differentials must be recognized. Bessemer, \$19; basic, \$18; foundry, \$18@£18.50, f.o.b. Valley furnaces.

CConnellsville Coke—No additional contracting has occurred. Spot furnace is easier at \$2.85@£3, foundry remaining at \$3.75@£4.25, with sales chiefly at the lower level.

Company Reports

The Lucky Tiger-Combination Gold Mining Co.

Silver; Sonora, Mexico

A report of the Tigre Mining Co., S. A., for 1924 follows:

| | | |
|--|----------------|-----------|
| Ore produced (75,863.5 tons)..... | \$2,352,738.15 | |
| Loss in residue..... | 123,707.65 | |
| Concentrate produced (7,232.75 tons)..... | \$2,229,030.66 | |
| Cost of operation at El Tigre..... | 1,337,078.90 | |
| Operating profit at El Tigre..... | \$891,951.76 | |
| Sundry profit excluding interest..... | 12,628.05 | |
| | \$904,579.86 | |
| Los Chinos unit—development..... | \$28,335.93 | |
| Depreciation at El Tigre..... | 34,083.00 | |
| Provision for Mexican federal income tax..... | 9,302.36 | 71,721.29 |
| Net operating profit of the Tigre Mining Co., S. A., for 1924..... | 832,858.52 | |
| Add income and expense of parent company..... | 69,666.98 | |
| Administrative expenses..... | 99,195.17 | |
| | \$803,330.33 | |
| Appropriate for various reserve requirements..... | 8,448.22 | |
| Surplus..... | \$794,882.11 | |

Dividends paid in 1924 totaled \$836,944.29, or \$1.17 per share.

Development during the year amounted to 9,936.5 ft.

Following is a comparison of the costs per ton of ore for the years 1923 and 1924:

| | Unit Costs Per Ton of Ore | |
|----------------------------|------------------------------|---------|
| | 1923 | 1924 |
| Development..... | \$2.03 | \$1.72 |
| Mining..... | 3.76 | 4.18 |
| Milling..... | 2.55 | 2.15 |
| Marketing..... | 8.66 | 8.41 |
| General..... | 1.14 | 1.16 |
| Total per ton..... | \$18.14 | \$17.62 |
| Miscellaneous profits..... | .33 | .09 |
| Net cost..... | \$17.81 | \$17.53 |

The mine produced and the mill treated 75,863.47 tons of ore, assaying Au 0.183 oz., Ag 36.61 oz., Cu 0.44 per cent, Pb 1.20 per cent, and Zn 1.88 per cent.

The zinc content was less than last year and the iron considerably higher.

The mill produced 7,232.85 tons of concentrate, which assayed Au 1.87 oz., Ag 362.44 oz., Cu 4.20 per cent, Pb 12.17 per cent, Zn 17.07 per cent, Fe 16.06 per cent, and insoluble 16.1 per cent. The gross value was \$2,229,030.66, or \$308.18 per ton.

Consolidated Balance Sheet Dec. 31, 1924

| Assets | | |
|---|----------------|----------------|
| Total current assets..... | | \$1,587,641.44 |
| Development fund..... | | 476,475.73 |
| The Tigre Mining Co., S. A.: | | |
| El Tigre mineral property..... | \$7,457,403.76 | |
| Less cost and appreciation..... | 5,605,388.23 | 1,852,015.53 |
| El Tigre plant and equipment..... | \$637,095.00 | |
| Less depreciation..... | 557,278.00 | 79,817.00 |
| Los Chinos unit mineral property..... | 14,485.32 | |
| Concordia mineral property..... | 5,730.90 | |
| Adjust Mining Co., Arizona..... | 373.16 | |
| Real estate and residence—Douglas, Ariz..... | 7,000.00 | |
| Apache Powder Co., stock..... | 6,000.00 | |
| Furniture and fixtures—Kansas City..... | 500.00 | |
| State of Sonora, Mexico—amount advanced..... | 2,581.18 | |
| Claim against the Mexican Government..... | 59,452.79 | |
| El Tigre Hospital deficit..... | 7,270.32 | |
| Deferred charges to operation..... | 5,510.62 | |
| | | \$4,104,853.99 |
| Liabilities | | |
| Total current liabilities..... | | \$92,200.56 |
| Reserves..... | | 179,756.50 |
| Capital | | |
| Capital stock (par value \$7,153,370.00)..... | | \$3,832,896.93 |
| | | \$4,104,853.99 |

Officers of the Lucky Tiger-Combination Gold Mining Co., which is the holding company owning the entire capital stock of the Tigre Mining Co., the operating company, are as follows: President, H. Vanderslice; vice-presidents, W. A. Moses, A. E. Mosier, J. E. Rahm, and L. R. Budrow. Mr. Budrow is also general manager. Offices: Kansas City, Mo., and Douglas, Ariz.

Park Utah Mining Co.

A financial statement of the Park Utah Mining Co. for 1924, follows:

| Cash balance Dec. 31, 1923..... | | \$13,767.39 |
|---|--------------|----------------|
| Receipts | | |
| Ore sales, 70,576 tons @ \$13.76..... | \$971,479.41 | |
| Interest on bonds, bank deposits and loans..... | 7,802.64 | |
| Sale of bonds..... | 198,962.03 | |
| Accounts receivable..... | 260.49 | |
| Sundry receipts..... | 8,701.16 | |
| | | 1,187,205.73 |
| | | \$1,200,973.12 |
| Disbursements | | |
| Mine, mill and general..... | \$786,406.50 | |
| Net investment in loans..... | 30,000.00 | |
| Dividend No. 10..... | 150,000.00 | |
| | | 966,406.50 |
| Cash balance Dec. 31, 1924..... | | \$234,566.62 |
| Cash and readily marketable securities as of Dec. 31, 1924..... | | \$314,566.62 |
| Investments | | |
| 42,457 shares common stock of Daly Mining Co..... | | |

Average assay value per ton of production was 24.99 oz. of silver, 0.108 oz. of gold, 2.12 per cent lead, and 0.16 per cent copper.

Park City Mining & Smelting Co.

A financial statement of Park City Mining & Smelting Co. for 1924 follows:

| Cash balance Dec. 31, 1923..... | | \$257,264.05 |
|---|----------------|----------------|
| Receipts | | |
| Ore sales: | | |
| Concentrates 27,165 tons at \$43.358..... | \$1,177,831.52 | |
| Crude..... 15,682 tons at 32.054..... | 502,679.19 | |
| Zinc..... 9,043 tons at 19.394..... | 175,379.48 | |
| Leasers ore... 2,845 tons at 15.656..... | 44,542.93 | |
| Scrap lead.... 109 tons at 143.112..... | 15,600.00 | |
| | \$1,916,033.12 | |
| Interest on loans and investments..... | \$34,380.81 | |
| Dividend, Park Utah stock..... | 1,125.00 | |
| Miscellaneous receipts..... | 2,359.68 | |
| | 37,865.49 | 1,953,898.61 |
| | | \$2,211,162.66 |
| Disbursements | | |
| Mine, mill and other expenses..... | \$1,305,294.31 | |
| Net investment in securities..... | \$176,610.64 | |
| Dividends paid, Nos. 6, 7, 8, 9..... | 525,610.80 | 702,221.44 |
| | | 2,007,515.75 |
| Cash balance Dec. 31, 1924..... | | \$203,646.91 |
| Cash and readily marketable securities as at Dec. 31, 1924..... | | \$1,043,404.98 |
| Investments | | |
| Park Utah Mining Co..... | | 7,500 |
| New Quincy Mining Co..... | | 50,000 |
| Daly Mining Co..... | | 34,000 |

Total metallic contents in ores and concentrates were 1,723 oz. of gold, 1,132,351 oz. of silver, 23,485,355 lb. of lead, 1,109,013 lb. of copper, and 15,521,350 lb. of zinc.

Shattuck Arizona Copper Co.

The production of the Shattuck Arizona Copper Co. and costs per pound for the first quarter of 1925 are as follows:

| | Copper Ore | Lead Ore | Copper Silica |
|-----------------------------------|------------|-----------|---------------|
| Dry tons mined..... | 5,034.46 | 10,467.37 | 359.07 |
| Dry tons treated..... | 5,096.60 | 10,527.00 | 189.53 |
| Pounds metal recovered..... | 470,625 | 868,257 | 289 |
| Ounces silver recovered..... | 9,202 | 68,951 | 637 |
| Ounces gold recovered..... | 230.95 | 1,047.54 | 207.07 |
| Net operating cost per pound..... | 13.81c. | 9.62c. | |

The net operating cost is for delivered metal after credit for previous metal byproducts, and includes the expense of repairing the concentrator to mill lead ores.

| Earnings | | |
|--|-------------|--------------|
| Refined copper at 13.75c. per pound..... | | \$64,710.94 |
| Gold and silver (copper ores)..... | | 11,064.71 |
| Gross value of lead ore..... | | 152,043.25 |
| Gross value of silica ore..... | | 4,609.24 |
| Interest..... | | 8,091.87 |
| Dividends..... | | 510.00 |
| | | \$241,030.01 |
| Operating expense, copper..... | \$75,151.32 | |
| Operating expense, lead..... | 156,932.17 | |
| Operating expense, silica..... | 2,091.50 | |
| Administrative expense..... | 4,666.58 | 238,841.57 |
| Net income, before depletion and deferred development charges..... | | \$2,188.44 |

The results on lead ore are actual smelter settlements. The production from copper ore is inventoried at 13.75c. per pound for copper, 60c. per ounce for silver and \$20 per ounce for gold.

Freight Rates on Metals, Ores, and Concentrates
Carload Lots

Copper Bullion and Refined Copper

Table with columns: From, To, Rate per Ton of 2,000 Lb. All Rail, Via Gulf. Includes entries like El Paso, Tex. to Baltimore, Md. and various locations in Utah, Arizona, and Montana.

Marine Freight Rates

Table with columns: New York to, Rate. Includes entries for Hamburg, Liverpool, Antwerp, and Havre.

Lead Bullion (Pig Lead Where Shown)

Table with columns: From, To, Rates per Ton of 2,000 Lb. Includes entries for East St. Louis, Ill., Pueblo, Colo., and other locations.

Slab Zinc

Table with columns: From, To, Rates per Net Ton. Includes entries for Donora, Pa., Langloath, Pa., and other locations.

Zinc Ores and Concentrates

Table with columns: To, From, Rate per Net Ton. Includes entries for Altoona, Kan., Bartlesville, Okla., and other locations.

Rates on Ores and Concentrates

Large table with columns: From, To, Value of Product Rate. Includes entries for Butte, Mont., Anaconda, Mont., and various locations in Utah, Arizona, and Colorado.

(a) Minimum tonnage of 200 tons per day. (b) In open cars, minimum 80,000 lb. (c) Siliceous ore tailing. (d) Applicable on ore, only when shipped in trainload lots of not less than 10 cars and exclusive of switching charges at Rossland.

Value of Ores and Concentrates

Table with columns: From, To, Value of Ores and Concentrates Rate. Includes entries for Burke, Idaho, Bradley, Idaho, and various locations in Utah, Arizona, and Nevada.

(a) Minimum weight, marked capacity of car used, but not less than 80,000 lb. (b) Minimum weight, 80,000 lb. (c) Minimum weight, 40,000 lb. (d) Crude ore for concentration, 30c. per ton. (e) For \$9 value rate is 95c.; \$8 value, 90c.; \$7 value, 85c.; \$6 value, 80c. * Indicates a change of tariff since last report.

Mining Stocks—Week Ended June 13, 1925

Table of mining stocks including Copper, Nickel-Copper, Lead, Zinc, Gold, and Gold and Silver. Columns include Stock, Exch., High, Low, Last, and Last Div. with various price points and dates.

Table of mining stocks including Silver-Lead, Iron, Vanadium, Asbestos, Sulphur, Diamonds, Platinum, and Mining, Smelting and Refining. Columns include Stock, Exch., High, Low, Last, and Last Div. with various price points and dates.

LONDON QUOTATIONS, WEEK ENDED MAY 23. Table with columns for High, Low, Last, Date, and Per Cent, listing various international mining and metal prices.