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Mining Low-Grade Ore during Periods of High Price

It is not uncommon to hear reference made to low-grade ore reserves that will pay to mine during periods of high metal prices, particularly in the case of copper ores. In fact this is not a safe generalization; the advisability of such procedure will depend entirely upon circumstances. For example: Let us assume that a certain copper mine has an assured life of 10 years, producing 360,000 tons of ore per year, which is the maximum capacity; that the normal grade of the ore returns a net yield of 27 lb. copper per ton; also that in one part of the mine there are 360,000 tons of ore that will yield 21.3 lb. copper per ton, and that it is not necessary to mine this ore in connection with ore running 27 pounds.

We will suppose that the production cost is as follows: Mining, $1; transportation, 10c., and milling 60c. per ton, or a total of $1.70 per ton at the mine. For the cost of smelting, refining, marketing and depreciation, we will allow 4c. per lb. of copper.

We will assume (merely for the purpose of the present article) that the normal price is 14.3c., which will make the average profit from the reserves of better-grade ore $338,000 per annum; the cost of copper produced from the 27-lb. ore will be 10.3c. per lb. on the above cost basis. Allowing the same costs for producing copper from the 21.3-lb. ore, we will have a cost of 8c. per lb. at the mine and 4c. for smelting, etc., which will give a total cost of 12c. for producing copper from the 21.3-lb. ore. The profit on this ore will be $176,364, under average conditions.

The total life of the mine is 11 years, therefore the future life of the mine after operating one year will be 10 years, viz., by working the low-grade ore the first year, the reserves will be sufficient to supply 27-lb. ore for 10 years. If the 27-lb. ore is mined the first year, the reserves will contain nine years of supply of 27-lb. ore, and one year's supply of 21.3-lb. ore. Now let us assume that during the first year of the 11 years of production at this mine, copper averages 18c. per lb., but that thereafter the average will be 14.3c. up to the time the last of the ore is mined.

During high prices for metal there usually is an increase in the cost of production, due to higher wages and cost of supplies, but for the sake of argument, we will say that the costs are the same as during the low periods. On an 18c. copper market the profits then will be: On the 27-lb. ore, 7.7c. per lb. of copper; $2.079 per ton of ore, or $748,440 per year. On this 21.3-lb. ore there is a profit of 6c. per lb. of copper; $1.278 per ton of ore, or $460,008 per year.

If the 21.3-lb. ore is mined during the 18c. copper market, the operating profits for the year will be $460,008. Based on the future life of the mine, 10 years, this money should itself earn $289,345 at 5% compound interest up to the time the mine is exhausted, either for the company, by reinvestments, or for the stockholders themselves if paid out in dividends. By working this ore, 360,000 tons of 27-lb. ore is kept in reserve, which will be mined in 10 years under normal conditions. The present value of this ore is $338,000 deferred 10 years at 5%, or $207,498. The total credits from working the low-grade ore are $956,851.

If the 27-lb. ore is mined during the 18c. copper market, the operating profits for the year will be $748,440, which, in 10 years, should earn $470,768 at 5% compound interest. By working the 27-lb. ore, 360,000 tons of 21.3-lb. ore will be in reserve, which will be mined in 10 years at 14.3c. copper. The present value of this ore is $176,364, deferred 10 years at 5%, or $108,000. The total credits amount to $1,372,208 at the end of the year by working the 27-lb. ore.

It will be seen by this, that a balance of $370,357 is shown in favor of working the high-grade ore. While this problem could probably be expressed in a better way, it is plain to see that it would be more profitable to mine the best grade of ore possible at all times, and especially during high metal prices. It is evident that the principal value of low-grade ores lies in the possibility of working them, at prices sufficient to yield a profit, after the high-grade ore reserves are no longer sufficient to maintain the desired output. The conditions assumed in this case are, no doubt, extraordinary, but they serve to bring out the point of the discussion better than to assume ordinary working facts.

J. R. Finlay, in his "Cost of Mining," makes the statement: "That a mining property being an asset in process of liquidation, the more rapidly (other things being equal) that asset is distributed and the business wound up, the greater the present value." In other words, it may be said that the ore in a mine does not increase or earn any additional profit itself, but when converted into money becomes active and earns a profit itself. This means that it is most profitable to mine the best ore first.

Lake Superior Iron Ranges

During the last year, public attention, to a greater extent, perhaps, than ever before, has been directed toward the Lake Superior iron ranges and their resources. This has been due to several causes. The Congressional investigation into the affairs of the U. S. Steel Corporation and the latter's announcement of its intention to cancel its leases of ore lands owned by the Hill interests, were chiefly responsible for the publicity given to the situation as regards the future supplies of Mesabi ore. In Michigan, the State Tax Commission caused to be made, last summer, an expert appraisal of mines, which was published at length in the JOURNAL. This appraisal was more complete in certain phases than any other public document yet published regarding Michigan iron mines. In addition to these, the State Geological Survey of Michigan is preparing a volume which is expected to bring the situation up to a recent date, especially as regards the practical results of recent private exploratory work. Some of the advanced sheets of this work have already appeared. Through these agencies unusual publicity has been given to a large amount of material, which otherwise perhaps would never have reached the public.

The sum and substance of this seems to point to the end of profitable openpit mining of high-grade ores on the Mesabi Range within about 50 years. During this time underground mining may be expected to increase rapidly, with its attendant disadvantages and higher costs, as compared to steam-shovel methods. It seems to be the belief of many iron men that the Hill lands have been overestimated, both as to tonnage and quality of ore. It is safe to say that the reserves of the Mesabi Range are not being increased by leaps and bounds, and that the average grade of the ores mined therefrom will not increase as time goes on.

The Michigan ranges offer a remarkable contrast. This is more interesting in view of the fact that Lake Superior iron was first mined in Michigan about 60 years ago. From small beginnings, mining there continued to grow to good proportions, until it was suddenly overshadowed by the more spectacular discoveries in Minnesota. The Michigan ranges have not lost ground, however; not only have they held their own, but they have made distinct advances. It appears now that as regards reserves and grade of ore, the Michigan mines have never been in as good condition as they are today. The prospects for more ore are particularly good. In many of the districts, the limits of the ore area are being extended both horizontally and as to depth, with maintenance of grade. As a field for iron-ore exploration, the Michigan ranges occupy an attractive position, and the state bids fair to regain the position it once held as a producer of iron ore.

Tharsis Dividends

The annual reports of the Tharsis Sulphur and Copper Co. are interesting as the record of a successful mining company extending through a good many years. This company paid its first dividend during the year ended Apr. 30, 1868, and since that time in only two years has it failed to pay a dividend. The actual gross profits up to the end of 1911 were £13,462,095. We judge this to represent what we ordinarily call the operating profit, and the figure is subject to the deduction of £1,348,768 for the cost of administration, and taxes, and the loss through bad debts, etc. A further large sum out of the gross profits has gone into the replacement of plant. When a company has been in operation for about 45 years, there can no longer be any illusions respecting what is or is not depreciation. The result is that out of the gross profits of £13,462,095 the actual net profits were £9,544,550, substantially all of which has been paid out in dividends. After all, the payment of dividends is the best measure of what a mining company is really making, although the passage of a period of years may be necessary to determine this.

The copper market this week seems actually to have run away, the operations for the rise in London having been unbridled and our market having naturally followed. This was the result of the large decrease in the report of European stocks at the beginning of June and the strong belief that the American figures will also show a decrease. The increased production of the smelters seems literally to have vanished, to where no one can say. Some persons are beginning to persuade themselves that there is no increase, arguing that the statistics are wrong. This implies equivocation on the part of the 10 or 20 smelters, who regularly make reports, errors in the government returns, etc., and no sensible persons will take any stock in such arguments. The price for copper is higher than it ought to be, and the penalty will, of course, have to be paid.

An interesting exploration venture has been organized on a large scale by some prominent Canadian and American capitalists, who have created the Canadian Mining & Exploration Co., Ltd., with an "endowment" of $2,500,000. The income from this fund will be used for investigating promising prospects. When desirable properties are found, the development of these prospects will be taken by a corps of competent engineers. Such a plan is followed in a general way by many large mining corporations, but this is one of the few instances where the income from a certain sum is definitely set aside for intelligent exploration.

By the Way

In a recent list of mining and metallurgical patents published in one of our exchanges we note: "A method for firing submarine mines." We presume that this refers to mines that labor under a burden of watered stock.

Actors, statesmen and others in the public eye have been "honored" by having a favorite brand of cigar named after them, but we believe that the recently marketed "Tungsten" cigar is the first case of recognition of the noble or base metals in this way. We presume it "lights" well.

"As to Prospecting," there is Gold in Pennsylvania and in Texas, Silver in Montana, Michigan, Minnesota, Arkansas, South Carolina and Texas, Zinc in Arkansas and a new town in the Cuyuna iron district in Minnesota is called Manganese. Ontario has its Cobalt and the Postal authorities find it also in Connecticut. There are "Cobre" (copper) galore in the Southwest and in Mexico, but no Copper in the United States. Antimony is in Arkansas, and in South Dakota is what seems to be Lead, but isn't. Mercury is rightly in Texas and Uranium in Colorado. There is Radium in Virginia, Minnesota, Kansas, and in Colorado where it really occurs in considerable quantity.

Salt Lake City has long been recognized as a mining and smelting center, being surrounded by the camps of Bingham, Alta, Tintic, Mercur, Ophir, Stockton, Park City, etc. However, it is of interest to call attention to the amount and value of the metals produced close to the city, i.e., within an airline radius of 25 miles. As shown by statistics collected by the National Copper Bank, there was produced in Salt Lake County and those counties immediately contiguous to it, gold, silver, copper, lead and zinc, valued at $29,881,500 during the year 1911. This is nearly as much as the entire metal output of Colorado. If the radius is increased to 50 miles, the value of the metal production totals approximately $2,000,000 more than that for Colorado. Thirteen per cent. of the copper of the United States, including Alaska, is produced within 20 miles of Salt Lake City, and 51.2% of the developed or partially developed porphyry copper ores are within this radius.

One of the largest and most comprehensive relief maps ever constructed, has just been completed by F. A. Linforth and E. B. Milburn, of the geological department of the Anaconda Copper Mining Co., assisted by A. Grimes and P. Billingsley, of the same office. It consists of a papier-maché relief map of the State of Montana, 14 ft. long and 7 ft. wide, colored to represent the different vicinities, the names of which are printed on the surface, and made to an accurate scale of about 4 miles to the inch, for both distances and elevations. On it are shown the railroads, rivers, lakes, valleys, mountains, cities and all of the developed and undeveloped water-power sites in every section of the state. The map was designed for the Butte Electric & Power Co., to show in an accurate and condensed form, the electric-power plants and network of electric lines traversing the state. Miniature poles and wires are placed on the map, showing the different routes. It is a perfect topographical representation of the state, and after it has been on exhibition in the windows of the electric company's office for a short time, it will be placed in a glass frame and kept in the drafting room for reference.

We have previously noted in our columns that the state of South Australia gives aid to prospectors. The method seems scarcely as hazardous as grubstaking, since it consists in giving help where a prospect has already been discovered, which seems promising. Up to date, however, the state has aided 110 individuals and corporations with sums ranging from £10 to £3995, amounting in all to £55,237. Of those so aided, two made sufficient profits to repay the advances and the machinery of five sufficed to pay their debts. Eighteen more made partial repayments, amounting to £1376. The remaining 85 received. Notwithstanding that only £6111 were returned out of £55,237 loaned, the state report comments cheerfully as follows: "A portion of this outstanding debt is represented by machinery which has fallen into the hands of the government; add to this the value of the metals won, and the state in general will probably have benefited beyond the money value of the debit balance."

A new exploration company has been organized on somewhat novel lines by Ambrose Monell, president of the International Nickel Co. and also of the Dome Mines, Ltd. The new company will be known as the Canadian Mining & Exploration Co., Ltd., and will have a nominal capital of $5,000,000 divided into shares of $5000 par. Of this capital, one-half will be paid in, this amount having already been subscribed. This $2,500,000 will constitute an "endowment fund" which is to be invested in standard securities, and the income, only, used for the purposes of exploration. When suitable properties are found, the subscribers to this $2,500,000 fund will be invited to participate proportionately in syndicates to be formed for the development of such properties. For this privilege the subscribers waive interest on whatever amounts they have contributed to the fund. The engineering work will be done by a staff under the direction of William Mein, now consulting engineer of the Dome Mines, Ltd. Properties will be examined and if found desirable, capital will be furnished under the plan described. Although the company is chartered in Canada, it will be international in scope and will undertake operations anywhere if satisfactory profit can be shown. Offices will be established for the present in New York, Toronto and Victoria, B. C. Mr. Monell will act as president without salary. The exploration company is the outcome of the success of the so called Monell syndicate in the acquisition of the Dome mine at Porcupine. A number of prominent Canadians have been interested in the new venture, in addition to those who were associated with Mr. Monell in the first operation. The Americans on the directorate include such men as William E. Corey, E. C. Converse, P. A. Rockefeller, A. H. Wiggin, T. L. Chadbourne, Jr.; J. R. DeLamar, Ambrose Monell, C. H. Sabin, R. M. Thompson and C. L. Denison. The Canadian directors include Sir E. B. Osler, Sir Edmund Walker, Sir Edward Clouston, Sir William Mackenzie, H. S. Holt, Duncan Coulson, D. Lorne McGibbon, Wallace Nesbitt, K. C.; David Fasken, K. C., and P. J. McIntosh. The executive committee will consist of Messrs, McGibbon, Nesbitt, Converse, Rockefeller, De Lamar, Monell and Sabin.

It seems odd to find financial writers in London and Paris commending highly a law enacted in Kansas, U. S. A., says the *Evening Post*. The law approved of is one to make venders of securities responsible for their wares, and check the stock swindler in his work. There is much writing to the same purpose abroad, in which get-rich-quick promoters are called stock thieves. In Paris their industry has been carried so far that a special court has been provided to deal with financial swindlers and frauds. Besides that, an educational campaign is being conducted, both in France and Great Britain, to protect the unwary from the wiles of those who would separate them from their savings. The least this country could do, perhaps, was to furnish a legal pattern, even though it came from Kansas, for the American swindler has preyed upon the French investor as upon no other class of foreigners. The mining scheme is the best bait. Reams and reams of worthless mining stocks have been sold to the French investor, sometimes direct, but more often with the connivance of little French bankers, who get what is called a "rake-off." In some cases the venders, having widely distributed a worthless stock, have had the moral hardihood to assess it, taking a second toll of the credulous. There is no doubt respecting the existence of the evil, but we have doubt about the "blue sky" law of Kansas as a remedy.

Chronology of Mining for May, 1912

May 1—Giroux Consolidated Mines Co. began ore shipments to the Steptoe Valley works.—Workmen struck at the Murray plant of the American Smelting & Refining Co. at Murray, Utah.

May 6—The Eureka & Palisade R.R. resumed operation in Nevada.

May 10—First lot of electrically smelted pig iron shipped from California to Salt Lake City.

May 13—Strike of workmen at Baltimore Copper Smelting & Rolling Co., at Baltimore.—Cave-in at Norrie iron mine in Michigan killed seven men.

May 15—First blister copper made at Hayden plant of American Smelting & Refining Company.

May 16—Government filed suit against the Aluminum Co. of America, to restrain it from illegal practices.

May 23—Fire destroyed the stamp mill of the San Miguel Mining Co., under lease to the Junta mine in the Telluride district, Colorado.

May 20—Ore-washing plant of the Wisconsin Steel Co. started operations at Nashwauk, Minnesota.

May Mining Dividends

May seems to be a lean month for mining dividends. The totals reported last month were only $1,263,015 for U. S. mining companies, $9,574,642 for metallurgical, coal and holding companies, and $468,440 for Canadian and Mexican mining companies. This, however, compares favorably with May, 1911, when the amounts reported were: U. S. mining companies, $569,677; metallurgical, coal and holding, $8,682,158; and Canadian and Mexican, $528,353.

United States Mining Companies	Situation	Per Share	Total
Alaska Mexican, g	Alas	$0.20	36,000
Alaska Treadwell, g	Alas	0.75	150,000
Alaska United, g	Alas	0.54	90,100
Arizona, pfd. B., c	Ariz.	...	53,842
Bunker Hill & Sull., l. s.	Ida.	0.15	65,400
Bunker Hill Con., g	Calif.	0.15	15,000
Champion, c	Mich.	1.00	100,000
Elkton, g	Colo.	0.01	25,000
Fremont, g	Calif.	0.02	4,000
Frontier, z	Wis.	2.00	2,500
Golden Cycle, g	Colo.	0.02	30,000
Hecla, l. s	Ida.	0.02	20,000
Homestake, g	S. D.	0.50	109,200
Knob Hill, g	Wash.	0.00½	5,000
Miami, c	Ariz.	0.50	332,496
Parrot, c	Mont.	0.15	34,477
Success, z	Ida.	0.02	30,000
Utah Con., c	Utah.	0.50	150,000
Wasp No. 2, g	S. D.	0.02	10,000

Coal, Iron, Industrial and Holding Companies	Situation	Per Share	Total
Amalgamated	Mont.	1.00	1,538,880
Cambria Steel	Penn.	0.62½	562,500
Internat. Nickel	U. S.	1.50	133,689
Lehigh Coal & Nav	Penn.	1.00	482,936
National Carbon	U. S.	1.75	78,750
Penn. Steel	Penn.	2.50	413,500
U. S. Steel pf	U. S.	1.75	6,304,919
Warwick I. & S	U. S.	0.40	59,468

Canadian, Mexican and Central American Companies	Situation	Per Share	Total
Amparo, g. s	Mex.	0.03	60,000
Buffalo, s	Ont.	0.03	30,000
Coniagas, s	Ont.	0.30	240,000
Crown Reserve, s	Ont.	0.05	88,440
Standard, s. l	B. C.	0.02½	50,000

Miami enters the list of dividend payers with a 10% declaration, the first of the Arizona "porphyries" to begin payments. Amalgamated at last fulfilled the prophecies of its adherents, and doubled its dividend. Success and Wasp No. 2 increased their dividends, as did Alaska Mexican and Alaska United.

Among the foreign companies, Standard Silver-Lead, which paid its first dividend in April, made an increased distribution in May, but this was not sufficient to overcome the cut in Coniagas in making up the general foreign total.

Mining dividends (United States companies making public reports) for the first five months of the year amount to $22,047,305, and mining, metallurgical and allied companies in North America, $66,304,108.

Mining in Colorado

By William Weston*

That Colorado is on the verge of a great mining era, may now be asserted without fear of contradiction; but it were idle to make such a statement without evidence to prove it, and here it is. In the first place in Denver alone, the banks have more money in their vaults than ever before, its saving deposits being upwards of $70,000,000. The pockets of capitalists have been buttoned up now for four years, with an entire absence of speculative investment, and as everyone knows, there is a limit to the idleness of capital, and it has been reached. The price of silver, zinc and tungsten has gone up, and within a year, the mining of uranium and vanadium ores has become an important industry.

The deep drainage tunnel of the Cripple Creek mines and the Newhouse tunnel in the Central City district, have rendered available more than 700 ft. in depth of ore area over at least four square miles in each. In the former this was accomplished by simple unwatering, and in the latter by the same process, together with the facility offered of overhead working, and haulage to the surface instead of hoisting, with, of course, the elimination of the great cost of pumping in both. Then we have the absolute knowledge that by new metallurgical methods, ores of a value of say $3 to $5 are being treated at a profit in Cripple Creek, this statement being backed by the incontrovertible evidence of big dividends. This knowledge has spread to the other camps of the state, and the result of all the foregoing is, that more deep drainage and transportation tunnels are being driven and more mills are being built than ever before in the history of the state, and as has been chronicled in the JOURNAL, mines idle for 10 to 20 years are being reopened to get at ores which were left as of no value, but which it will now pay to extract. Then we have proof that the La Plata district, near Durango, and the Gold Brick and Quartz Creek districts, near Pitkin, in Gunnison County, are coming into prominence as producers of both noble and base metals.

Owing to the unusual moisture that our lands have had, it promises to be one of the most successful farming and fruit years in the history of the state, and though this is foreign to the purpose of a mining journal, it should be remembered that when people are making money in these and other lines, those speculatively inclined naturally turn to mining, which is still the leading, and the most attractive industry of the state.

That the railroads realize the truth of all the foregoing is evidenced by the large steel orders given by the Rock Island, Rio Grande, Santa Fé and Hill lines to the Minnequa plant, at Pueblo, which is running day and night with full force in its endeavors to catch up with these heavy demands on its capacity.

Let us not forget too that coal has been the great factor in creating strength of nations and of states, and that in Routt County, Colorado, are 1200 square miles of fine bituminous coal, of an aggregate workable thickness of 50 ft., as yet practically undeveloped and without adequate transportation facilities to make it available for the use of the people of the states west of the Missouri River, who badly need it, and who must soon have it. All this seems to be sufficient evidence to prove the truth of the statement that we are on the verge of a great mining revival in Colorado.

Zest has also been added to the mining game here by the late big strike in the Florence of Goldfield, Nev., which is owned by two Denver men and has made millionaires of them. The stock is reported to have gone from 67c. to $1.20 in one day on the San Francisco market. According to a telegram received by A. D. Parker, the chief owner here, a streak of ore in the vein runs as high as $5000 per ton, and it is such occurrences as these which direct attention to the possibilities of making great fortunes and arouse the spirit of speculative investment.

*965 Gas and Electric Building, Denver, Colo.

Peculiar Louisiana Oil

The oil from the well recently drilled by the Myles Mineral Co. at Pine Prairie, La., is remarkable, according to an analysis made by the U. S. Geological Survey, in that it contains no asphalt, gasoline, or paraffin wax. The crude product contains a large percentage of illuminating oil. In composition the oil stands about halfway between the oil of the Gulf and that of the Caddo field.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Why Mining Languishes

In an editorial in the JOURNAL of May 25, 1912, among reasons why mining languishes, the unjustifiable price put on property by mine owners is suggested.

It is questionable whether the owner is often responsible for the price at which the property is offered. My impression is that a great majority of properties come to the would-be purchaser through one or more "go-betweens," or promoters. Men who operate on a large scale know the principal exploration companies looking for developed mines. Few, however, are the properties offered by such operators. More frequently an interest in a promising prospect is purchased from the locator by some dealer in general merchandise or by a saloon keeper, who then furnishes funds to develop the property until it may be called a mine, and this is the man who attempts the sale. Such a man knows no exploration company, but meets the usual mining shark, who frequents promising mining camps. The latter has a friend in the East who presents the property to the exploration company, if, fortunately, it does not go through more hands. Now if the prospector and his partner agree on a price of $100,000, which likely is a reasonable one, and if the partner is honest, the property probably goes to the friend in the East at $150,000, and the price at which it is offered is $200,000. Often the store keeper wants a "rake-off" and adds $25,000 for himself, and the final price to the exploration company is raised to $225,000, or even more, depending upon the number of hands that it goes through.

A mine which, during development, has shipped $200,000 and had considerable ore remaining, was offered in Denver a few years ago for $2,000,000. The simple reading of the report showed that the property was not worth the money. A few years afterward, in conversation with one of the owners, it was learned that the price made by them was $500,000, at which figure an examination on the ground was justified.

Sometimes promoters learn by experience, and there are now some good men who actually visit properties themselves and know what they are offering, who act for a 10% commission. Such men are bound eventually to build up a good business, for those engineers who have spent time and money looking at so called million-dollar properties, which have dwindled on examination to "A hole in the ground owned by a liar," are glad to send clients who may be looking for a property to a reliable promoter.

Other conditions also enter into the question of purchase. Thus, in the last report of the Tonopah Mining Co., its engineer states that "Certain kinds of mines are eliminated because they are outside of the class in which the Tonopah Mining Co. feels that, by experience and equipment, it can rank as a specialist." One of the properties referred to in the report quoted in the editorial was examined and not purchased, but has since been acquired by another company so situated that it can handle the ore more cheaply and advantageously.

GEORGE A. PACKARD.

Butte, Mont., May 29, 1912.

History of the Cyanide Process

I may call attention to one or two manifest errors of dates in the obituary of the late H. Forbes Julian in the JOURNAL of Apr. 27. You say that in 1887, as consulting engineer of the Johannesburg Pioneer Company he erected a cyanide plant and in 1888 be erected a better one at the Roodepoort United Main Reef. It is a well known fact that the first plant to treat ore commercially was at the Crown Mines of New Zealand at Karangahake in 1889. In 1890 the Cassell Gold Extracting Co. erected the first Transvaal plant at the Salisbury battery. This was an experimental one, the good results at which lead next to the erection of a larger commercial plant at the Robinson mine, for which see J. E. Clennell's "Cyanide Handbook," p. 30. The date of the MacArthur-Forrest British patent was July 16, 1888, following a provisional specification lodged Oct. 19, 1887. The granting of this patent was held up for want of a suitable precipitant and on filing specification covering the use of "filiform" zinc on July 14, 1888, the objections of the British patent office were overcome and the patent granted. Two American patents were granted under date of May 14 and Dec. 24, 1889, referring to solution and precipitation respectively. Mr. Clennell in his book, I may say in passing, has been uncharitable enough to refer to my own action in securing a caveat, as "alleged." In fact the records of the patent office will show that I took out a caveat in May, 1886, through my father, being a minor at the time. There was much good fortune attached to my own discovery, but youth and other things prevented my bringing the matter to a successful termination. In attempting to secure capital and assistance in putting it into practice I met with so many rebuffs that I began to doubt its efficiency. Few men could have done as well technically as J. S. MacArthur and it has always been a source of satisfaction to me that a man of his character and integrity should have reaped the rewards that I failed to receive. LOUIS JANIN, JR.

California, May 3, 1912.

Vertical vs. Inclined Shafts

Referring to the abstract on the above subject (ENG. AND MIN. JOURN., May 18, 1912, p. 985), I would call attention to the danger of misleading many small operators into a disastrous choice of one or the other of the methods, because of lack of explicitness in applying the arguments as advanced for one or the other systems.

I have found that these little items and discussions form a textbook and manual to many prospectors and small miners, and have met with instances wherein the course chosen was the direct cause of failure and loss to those who were putting their labor and money into an operation.

Among the axioms of the practical Western engineer will be found this: "Stay with your ore." This is with reference to prospecting, and especially in developing a new district. Many are the instances in which a vertical shaft well equipped and carefully excavated, has been sunk and sunk till the funds were about exhausted, a crosscut driven on an emergency decision and, if the lode or vein is reached before the final exhaustion of the funds, only to find it in a barren section. After this there is little on which to base a call for additional funds with which to conclude the proper testing by drifting on the lode, which may later, when worked by new people, disclose the ore. The original operators are out their money and labor.

Had the lode been followed by an incline, the ore, its character and quality and much additional information, would have been acquired. The location of the orebodies would have been determined; this, together with the most economical surface arrangement, would determine the location of the main working shaft, which may be vertical or inclined, as business conditions may determine. Such a working shaft may then be raised much

more economically than sunk, the water will not hinder and the job can be best done in every respect, and in most of the states, will be in compliance with the laws requiring two openings, and even without such law will be good practice. The foundation has been laid for such a shaft, and the ore will show for and justify the necessary capital outlay for it.

Reason (2), in favor of the inclined shaft, that the ore extracted will partly pay expenses, is valid, and the objection (4), that good ore surrounding the shaft is lost, is not tenable, as this ore will ultimately be recovered, the once main incline being converted into a working raise and the ore from the shaft pillars will be removed, as in the usual course of mining operations.

Reason (3), that the vein is often softer than the country rock, is valid, and offers the additional advantage of presenting the walls, or, at least, one to break to, making the sinking costs in an inclined shaft less than in a vertical, in country rock.

Disadvantage (1), that veins usually carry more water than the walls, is more imaginary than pertinent, and in the end it will be found that the pumping costs in mining will be less with the incline than is usually the case with the vertical. There is not always more water in the lode, but in any event this water is drawn from the contiguous sections of the lode and sinking can be continuous. On the other hand, in the case of the vertical shaft, in a new district, every seam or fissure crossed, and usually these parallel an inclined lode, affords its quota of water, which, at the point cut, presents a head to the standing level of the water and an excessive flow which usually floods out the pumps, delays sinking and adds unnecessarily to the cost.

Once the lead has been reached, this flow is to be cared for through all future time, and comes nearer being all the water of the region than is the case of the incline on the lode which deals with the water of the region of the lode, that must be dealt with in either case.

Of the advantages of the vertical shaft, (1), reaching maximum depth in minimum time, is open to question, and the relative speed will depend on several factors: character of rock; condition of walls at crossings of seams; inflow of water; and length of suspension on cutting a flow, where, as I have seen happen three times in sinking 300 ft., work was suspended for a total of several weeks and the pumps drowned out. To this sinking time must be added the time taken to crosscut, not depth below surface but depth on lode being the desideratum.

As to advantage (2), ease of sinking and timbering, my experience and that of engineering acquaintances, is quite to the contrary both as to speed of driving and ease of timbering, and is that the cost of the incline on the lode is much less than with a vertical shaft. Pumping, as mentioned in advantage (3), will depend on the arrangements for handling the pumps in either case. The best arrangement will depend on conditions and the judgment and ingenuity of the man in charge, and affords considerable room for saving costs and increasing speed of sinking. I can see no reason why this can be better done in one type of shaft than in the other, unless it be that in the incline, the pump can rest on skids and requires less care in suspension, and is more out of the way of blasting, in the incline where it is also easier to reach for packing and repairing.

Into the question of economy of handling the ore, advantage (4), many factors enter. In a mine of nominal capacity as many of the Western mines for gold, silver, lead, etc., the question of maximum capacity does not call for consideration, and rapid hoisting is eliminated. Yet even on this score, the Lake Superior copper inclines present an example of long and justified experience in the large permanent mine workings. Where the crosscut from the vertical shaft begins to lengthen out, especially with a small mine, the constantly increasing costs here tend to offset the seeming advantage in vertical hoisting.

We cannot be too clear as to the relations of points under discussion, and, in the above, I am considering the relative merits of the two types of opening an ore lode, with reference to the earlier operations, those of small operators, and those in new districts.

First, expose the outcrop as far as practical by cuts and trenches, then "Follow the ore" where the surface and economic conditions best justify.

L. S. ROPES.

Helena, Mont., May 26, 1912.

The Pattinson Desilverizing Process

The ENGINEERING AND MINING JOURNAL for May 4, 1912, p. 907, has the following item: "John Pattinson, a distinguished chemist and inventor of the Pattinson process of desilverizing lead, died at Newcastle, England, Mar. 12, aged 84 years."

The "Metallurgy of Lead," by John Percy (1870), p. 121, gives the following: "Mr. (Hugh Lee) Pattinson was of humble parentage and born at Alston, in Cumberland, where he was employed professionally as lead assayer to the Commissioners of Greenwich Hospital, and he died at Newcastle-upon-Tyne, Nov. 11, 1858. He was a self-made, observant, ingenious, clear-minded, upright man, whom I knew personally well, and whose memory I much respect. He communicated a paper on the history and nature of his process to the British Association in 1838, which was printed in full in their *Transactions*. He obtained a patent for this invention, dated Oct. 28, 1833, (No. 6497) and entitled 'An Improved Method of Separating Silver from Lead.'"

J. F. MILLER.

Trail, B. C., May 28, 1912.

Separating Blende from Barite

In the JOURNAL of May, 1912, Mr. Bryant describes an application of the well known property of barite, of decrepitating at a lower temperature than blende, to the treatment of the zinc ores of the Central Missouri district, and incidentally states, that although the process described has been successfully applied to the ores of 20 mines, it fails on the apparently similar ore of the Black Jack property. It may interest Mr. Bryant to know that I have recently been faced with the problem of separating blende from barite, and although well acquainted with the "decrepitation" method, preferred to apply the Huff electrostatic system, which proved successful both as to percentage recovery and grade of concentrate.

As is well known, blende is not repelled or separated from the barite, if the two minerals are submitted together to electrostatic treatment in their natural condition, but by a simple and inexpensive pretreatment (not partial oxidation), the blende can be completely separated from the barite.

I am not at liberty to give the details of the treatment I refer to, but feel sure, that if Mr. Bryant communicates with the Huff Electrostatic Separator Co., of 60 India Street, Boston, the information will be forthcoming.

CLAUDE VAUTIN.

London, England, May 24, 1912.

Pyrite Mines of the World

In the JOURNAL of May 4, 1912, is reprinted a statement from the *American Fertilizer*, of Mar. 23, 1912, wherein it is said that our mines at Sulitjelma, Norway, are producing 35,000 tons of pyrites per annum for export. We wish to say that this statement is somewhat erroneous, since our present production of pyrites for export is about 125,000 tons per annum. This pyrites is chiefly sold in Sweden, Norway and Denmark, but also abroad in England and Germany. We also wish to mention that the pyrites contains about 2.75 to 3% copper and about 44% sulphur, and we have determined to increase our output, so that within a few years it will reach 160,000 to 170,000 tons of pyrites for export. In this connection we may also say that besides pyrites we are also producing about 2000 tons of high-grade bessemer copper per annum.

SULITJELMA AKTIEBOLAG.

Helsingborg, Sweden, May 17, 1912.

Feeders for Belt Conveyors

By Colby M. Avery *

The heaviest wear on a conveyor belt occasioned by the ore itself occurs just below the feeder and is caused by slippage while the inertia of the ore is being overcome. To reduce this wear the feed should fall upon the conveyor in the direction of travel and while moving at the same velocity as the belt. Feeders that fulfill these requirements are described.

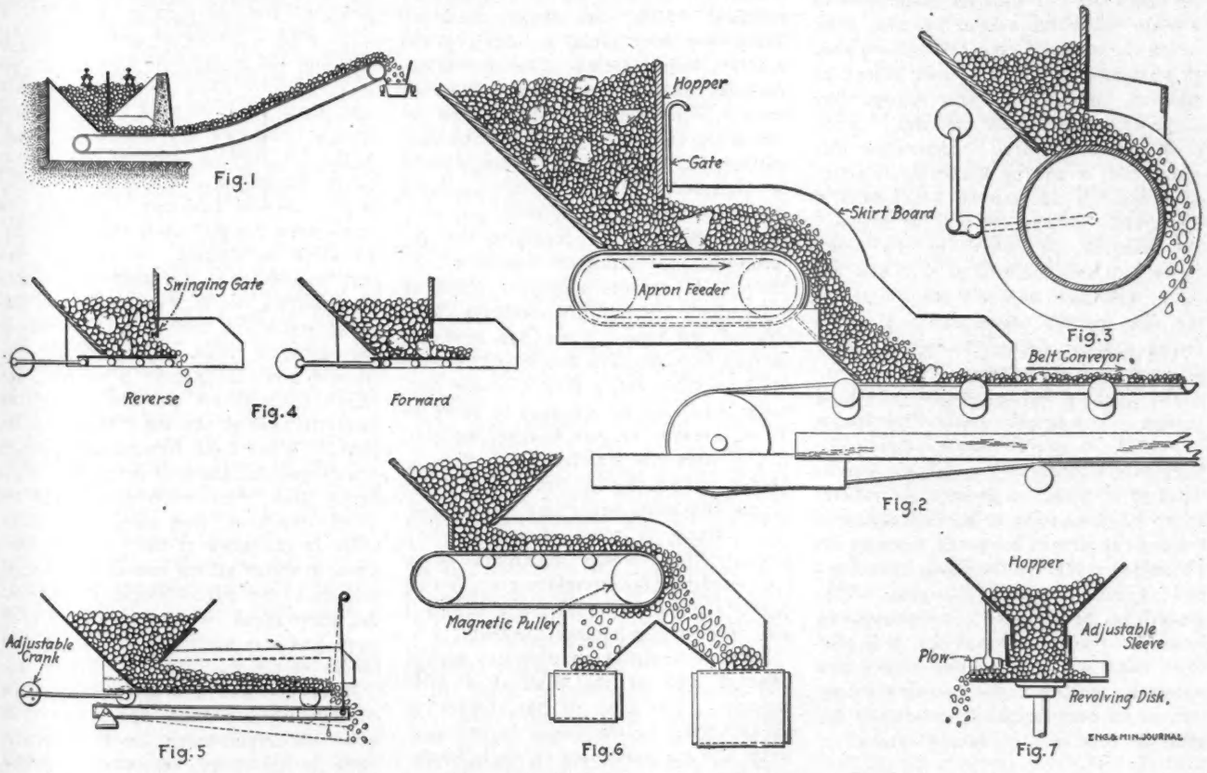
*Manager mine and smelter department, Stephens-Adamson Manufacturing Co., Aurora, Ill.

The constantly growing use of the belt conveyor as a rapid and economical device for handling material has resulted in the development of many types of machines for feeding the belt. A study of the causes of belt wear has revealed the fact that slippage of the material on the belt in the ordinary conveyor is the cause of the greatest amount of wear, which by proper refinements in design can be eliminated to a large degree. Of the three causes of slippage, two need not be considered at this time. Excessive incline of the conveyor is a condition that seldom obtains, and the "internal friction" of the load is of small consequence with properly designed carriers. The method of delivering the load to the belt, however, is a variable factor and one to which the greater part of the conveyor-belt wear is largely due. The inertia of the material dropped upon the fast moving belt must be overcome entirely by the friction between the belt and the material. Slippage at this point, before the material has obtained the same speed as the belt, frequently results in rapid wearing of the cover; consequently the belt fails. This action is especially apparent when gritty material is conveyed even when belts of the highest grade and therefore the most costly are used.

The belt wear at the loading point is naturally greatest when the material is fed from a chute at right angles to the belt travel and when it is fed in large quantities. Consequently the ideal condition is to feed the material uniformly and to feed it at the belt speed in the direction of the belt. This is accomplished by the use of automatic feeders delivering uniformly by chutes to the belt. The chute must be inclined toward the direction of the belt travel and of sufficient length to discharge the material at the approximate speed of the belt.

The type of feeder used must depend upon the material handled and upon other special conditions. A large number of types of feeders have been developed, but only those found most practical for meeting the various conditions will be discussed.

The apron feeder illustrated in Figs. 1 and 2, has recently been developed for especially large capacities and for handling heavy lumpy material. This feeder is essentially a heavy, corrugated-steel apron conveyor of short centers. It is placed directly beneath the hopper so that the material rests upon the apron, the flow being controlled by the motion of the apron. Apron feeders of extra large capacity have recently been built 48-in. wide by 8-ft. centers for handling run-of-mine ore in sizes up to 18 or 20 in. diameter. They are driven by ratchet-tooth wheels and pawls from an adjustable crank. The apron feeder may be arranged with gear-reduction drives and friction drives and it is built for a number of applications. It is handling ore of all kinds, coke, limestone, converter slag, and is even used for feeding directly into blast furnaces. This feeder also has the advantage of being able to serve as a conveyor and if necessary, may deliver the material at a fairly long distance from the hopper or even above the



TYPES OF AUTOMATIC FEEDERS FOR CONVEYORS OR CRUSHERS

hopper. In fact, the chief advantage of a feeder of this type is that it requires little head room and may deliver at any convenient distance from the hopper opening.

Feed May be Accurately Adjusted

The automatic rotary ore feeder illustrated in Fig. 3, is one of the simplest feeders on the market; the only moving parts are the slowly rotating cast-iron drum and the driving mechanism. This type of feeder may be accurately adjusted to deliver any quantity of material. It occupies considerable head room, however, and can only deliver directly beneath the hopper opening, hence it is somewhat limited in its application.

The reciprocating plate feeder illustrated in Fig. 4 is a type largely used where a constant feed is required. This feeder is simple in design and reliable in its operation. It consists essentially of a plate below the hopper opening, upon which the material rests. It is connected to a crank or eccentric so that in its rear position, it extends just beyond the angle of respose of the material. As the plate moves forward, it carries the material with it and as it returns it slides from beneath the material which falls to the chute. This feeder may be adjusted by changing the length of the crank throw, but the quantity of feed can not be as accurately adjusted as in either of the two feeders aforementioned. This feeder can not deliver the material at a distance from the hopper.

The shaking feeder shown in Fig. 5 is also a type largely used. This feeder is set at an angle, usually about 12°, beneath the hopper. It consists essentially of a trough supported on rollers, or by swinging rods, or a combination of both. It is shaken back and forth by an adjustable crank and the angle of inclination is also usually adjustable. This feeder may be extended any distance and is adapted to large capacities. It is also often used as a combination feeder and screen by placing finger bars in the bottom, as its construction is essentially the same as that of the shaking screen.

Magnetic Device for Removing Iron

The belt feeder is a type similar to the apron feeder in its advantages, but adapted to the use of fine material. A very heavy conveyor belt is used, supported on flat rollers closely spaced. This same type of feeder may also be used as a magnetic separator and feeder, by using a magnetic head pulley. Discharge may then be made to a double chute arranged as shown in Fig. 6, for the separation of the magnetic and non-magnetic materials. This arrangement is advantageous where it is desirable to separate the materials.

Another feeder extensively used is the revolving disk feeder shown in Fig. 7. This feeder is adapted to handle finely crushed substances in relatively small quantities. It is easily adjusted for accurate measurements and hence where exact proportions are required, a number of these feeders may be arranged to deliver the various materials to a belt conveyor. This feeder consists of a horizontal disk beneath a hopper opening. An adjustable sleeve is fitted around the hopper discharge spout, which may be raised or lowered relative to the disk thus controlling the area of the disk covered by the material. As the disk revolves, the material outside the sleeve is scraped off by a plow in quantities depending upon the position of the sleeve.

Uniform Feed Permits Using Small Conveyors

There are many types of feeders of practical value, but those described above have been found to meet best the ordinary requirements. The special advantages of each have been mentioned only in a general way, and only so far should the statements be taken as authoritative. The use of a feeder may always be regarded as an economy wherever coarse material is drawn from bins on a belt conveyor. The regularity of the feed, not only saves the conveyor belt, but it also permits a smaller conveyor being used, loaded to its maximum capacity all the time. Some fine material, such as dry sand, will flow regularly from the hopper without a feeder, or the conveyor may even be arranged to serve as its own feeder without wearing the belt. Heavy abrasive material may also be carried with relatively little wear if the feeder and chute are properly arranged. One instance is noted of a single belt properly fed, which according to a registered-tonnage weightometer carried 3,500,000 tons of abrasive ore before it was necessary to replace the belt.

Such economy is an absolute saving, effected only at the cost of a little thought. The cost of the feeder is usually offset by the saving in conveyor width and the chute may as easily be designed to save the belt as to wear it.

The use of a feeder to protect a crusher is also a point deserving mention. It frequently happens that on account of bad judgment a crusher is placed directly beneath a hopper so that when the hopper is full the load rests directly upon the crusher rolls. The result is that if the crusher is not stalled, it operates at double its rated capacity for a short time and is then idle for a longer time. The life of the crusher under this treatment is consequently about half of what should reasonably be expected and the power consumption is greatly increased. Where a crusher must be used, it should always be protected by a feeder and if discharge is made to a conveyor, it should be by means of a properly constructed chute. Inspection of Fig. 7, will show the advantages of this arrangement.

Sir Julius Wernher

Sir Julius Charles Wernher, whose death, on May 21, has already been briefly noted, was one of the strongest influences in the building up of South Africa and the management of its great mining interests. While he was rather retiring in his ways and was never so prominent in the public eye as Cecil Rhodes, Barney Barnato or even his own partner, Alfred Beit, he was in reality a force second only to Mr. Rhodes in his real influence.

Like so many of the South African mine-owners, Sir Julius was of German descent. He was born at Darmstadt, in 1850, from a family of good commercial standing and received an excellent education. Shortly after the Franco-German war, about 1871, he went to Paris, where he was employed by the firm of Porges & Co. A year or later he was sent to South Africa, in company with Charles Nege, who was a partner in the firm, and established himself at Kimberley, where he acted as diamond buyer. He was very successful in this business and also in acquiring some interests in the diamond mines and was made a partner in the firm in 1878. The Porges firm formed the Compagnie Francaise des Mines et Diamants du Cap, which was generally known as the "French Company." When Cecil Rhodes undertook to consolidate the diamond interests at Kimberley, this "French Company" was his chief opponent, and secured a large share in the stock of the De Beers company, in which all the interests were consolidated. Sir Julius Wernher conducted the negotiations on the part of his company, and was made one of the life governors of the De Beers.

When the gold discoveries were made on the Witwatersrand, Sir Julius early saw their importance. He had already, while at Kimberley, associated with him Alfred Beit, who had gone there as diamond buyer for the Lipperts, of Hamburg, and the firm of Wernher, Beit & Co., which established itself at Johannesburg, early, became a powerful influence in the Transvaal. He also became a partner in the allied firm of Eckstein & Co., which was interested in some of the more important of the new gold mines, and together these firms directed and controlled much of the development which has made the Transvaal at the present time the greatest gold-producing country in the world.

During all this time, Sir Julius, in accordance with his usual custom, remained

mostly in the background, although he was really the dominating force. After his two firms had been well established in Africa, he removed to London and did not visit the Transvaal again until after the conclusion of the Boer war. It need hardly be said that in the course of these transactions he had accumulated a very large fortune. Indeed, he was said to be one of the richest men in England. He bought Bath House, a well known London mansion, which is filled with pictures and other art objects, although he avoided, as far as possible, all display. Recently he made several arrangements looking to his withdrawal from business. A contract was made toward the end of 1910, by which the Central Mining & Investment Corporation, which had been founded and managed a few years before by him, acquired the business of Wernher, Beit & Co. and of H. Eckstein & Co., with the exception of the diamond business. Sir Julius was made a life director in this corporation, and for a time acted as chairman of the board. Later the diamond branch of the business of Wernher, Beit & Co. was transferred to L. Breitmeyer & Co., of London and Amsterdam, this last transfer taking effect Jan. 1, 1912. The firm of Wernher, Beit & Co. then passed practically out of existence.

Although he controlled so many companies, Sir Julius did not take a prominent titular part in the management of any of them. Outside of his South African companies, he was chairman of Fraser & Chalmers, the manufacturers of mining machinery. He was much interested in mining education and was active in forming the plans for the improvement of the Royal School of Mines in England, to which he was a liberal contributor. He also gave largely toward the establishment of the proposed University of South Africa, and it is understood that that institution will benefit largely by his will, in addition to the large bequest which it received from Mr. Beit.

A singular incident in his career which came prominently before the public some three years ago, was his purchase for £64,000 of an alleged process for making artificial diamonds, invented by a Frenchman named Lemoine. The lawsuit which arose out of this transaction excited much interest.

His heir is his son, Derrick Julius Wernher, born in 1889. What actual disposition of his property has been made by his will is not yet known, but as we have noted above, he seems to have made preparation for his final retirement from active business. He was about the last survivor of the group of prominent and wealthy men, whose fortunes were founded on the diamond and gold discoveries of South Africa, and it is not impossible that some changes in management and methods may follow his death.

The Rand's New Metallurgy

A paper on "The New Metallurgy and the East Rand Proprietary Mines," submitted by H. Stadler to the Chemical, Metallurgical and Mining Society of South Africa, was rejected on the ground that no new technical facts were adduced. Mr. Stadler has appealed to the Transvaal Chamber of Mines requesting that it investigate the charges brought in this paper.

Methods too Refined

Mr. Stadler's paper was intended to prove his contention that present Rand metallurgical methods are becoming too refined and that a return to old-fashioned methods would result in greater economy. The following paragraphs contain a brief abstract of the arguments advanced by Mr. Stadler.

From figures contained in their memorable paper on "Rand Metallurgical Practice and Recent Innovations," Messrs. Denny drew the logical conclusion that, in order to get a total extraction of 95%, it is theoretically unnecessary to grind ore beyond the point at which 58% passes 100 mesh. In following the ultrafine-grinding policy, operators are considered to have overlooked the following factors:

(1) The higher extraction claimed for finer grinding, in consequence of mistaken deductions, has been grossly exaggerated. Actual figures show that the higher extraction obtained in favor of the fine pulp is only 1.5% or 5.4d. in a 7.5 dwt. ore. This amount is hardly sufficient to repay the higher cost of finer grinding.

(2) Any classifier with its overflow velocity well adjusted acts as an efficient concentrator, in which the specifically heavier pyritic particles are preferably retained in the underflow. Classifiers in which the pulp is partially banked up and disturbed are complete failures as concentrators. The abandonment, therefore, of the old proved spitzkasten in series in favor of cones in sets is a doubtful improvement.

(3) With the extremely fine pulp now generally in use, it is no longer reasonable to take the percentages left on the +60 grade as a criterion for the fineness of pulp. Besides the inaccuracy of screen measurements, it must be remembered that part of the particles left on the +60 grade are of exceptional flat or long shape and more amenable to chemical treatment than a similar volume of spherical form; or they are of specifically lighter materials and of a nature quite different from the ore since they carry neither pyrite nor gold.

Amalgam Extraction Reduced

(4) The profit resulting from higher extraction by finer grinding is practically nullified by forfeiting the good effect which the high percentage of extraction by amalgamation has on the total extraction. Crushing by impact in a mortar box is much more adapted to free the pyrite and gold from their gangue than the abrasive action of the tumbling contents of tube mills in which largely the particles are not broken up but ground down by surface wear. Formerly an amalgam extraction of up to 70% was easily reached, while, where the battery plates have been discarded, this extraction has now dropped, in most cases, to 50%. Besides the advantage of quick realization of profits, a high extraction by amalgamation has a far-reaching effect on total extraction consequent on the lowering of the gold content in the final pulp for cyanide treatment where only 85 to 90% is recoverable under the best actual conditions. The East Rand Proprietary Mines and the Crown Mines with up-to-date and costly methods of treatment have not succeeded in raising the percentage of extraction by cyaniding much above the level of 85% which is easily obtained all over the Rand.

(5) So far as Rand ore is concerned, grinding finer than +200 mesh is mere waste of energy and money. The great amount of over-worked slime unnecessarily produced inevitably demands more perfect washing and dewatering equipment in the cyanide works, with consequent additional working costs and additional capital expenditure.

Working Costs Higher

The different methods of recording and apportioning costs make a comparison difficult. However, in the progressive mines working costs for reduction work may generally be considered to be 1s. per ton higher than for other mines.

At the time of the introduction of the "New Metallurgy," it was urged that the adoption of the stamp-tube mill combination would result in greatly reduced capital expenditure. A comparison of the results given in the annual reports of companies using the old and new methods does not bear out this contention; the New Kleinfontein Co., which employs single-stamp crushing shows a much less capital outlay than those mills which employ double-stage fine grinding. Further, about a year and a half after the adoption of the new method, it was found that the capacity of the cyanide works at the East Rand Proprietary mine was inadequate to deal with the increased proportion of the slime produced by the score of tube mills.

While emphasizing the better economic efficiency obtained with the sounder and older methods, Mr. Stadler states that it is not his intention to advocate a definite doctrine of single-stage stamp crushing. On the contrary, he believes that multiple-stage crushing should be practiced in every rationally designed plant so as to realize the advantages derived from intermediate classifiers.

Limitations of Tube Mills

The use of tube mills for the purpose of grinding is not in question but rather their abuse. The abuse consists of transferring to them that part of the crushing work which can be more efficiently done with stamps. It has been proved experimentally that the mechanical crushing efficiency increases with the coarseness of the battery mesh. However, the advantage of a high amalgam extraction obtained by double amalgamation before and after tube milling is so marked, that to forfeit this advantage by crushing so coarsely that the battery plates have to be discarded is not advisable, unless the extraction in the cyanide works can be materially raised above the present level of 85 to 90%. The use of fine battery screens will, therefore, be advantageous even at the cost of a possible loss in mechanical efficiency. With classifying well carried out, the suitability of the type of tube mills adopted as a standard on the Rand is doubtful. Other crushing machines may prove more efficient and should be given a trial.

New Kleinfontein Combines Both Methods

When the New Kleinfontein Co. decided to increase its reduction capacity by 10,000 tons per month (25% increase) by the use of stage crushing, they adopted a policy by which both methods were logically combined. Of the 220 stamps only 40 will be made responsible for the increase of output. These will crush through the coarsest battery mesh, while the remaining 180 stamps will crush, as hitherto, through fine-mesh screens. The underflow of the total pulp is to be reground by tube mills which will work at a high efficiency because the 40 coarse-crushing stamps will provide them with the right amount of coarse material to produce the most suitable mixed feed. A high amalgamation extraction will be secured by a double amalgamation of the mill pulp produced by the 180 fine-crushing stamps before or after tube milling.

Mr. Stadler in closing states that his remarks against the wisdom of the all-sliming policy refer exclusively to Rand ore and present Rand practice.

California Oil Gushers

San Francisco Correspondence

The Amalgamated Oil Co. brought in a new well in the Fullerton field on May 28, that is reported as flowing at the rate of 10,000 bbl. per day. This well is only 1400 ft. deep, and is not in what is believed to be the best formation. All other important producing wells in the field are 2500 ft. deep, so the coming in of this gusher at 1400 ft. was a surprise. The gas and oil shot the tools out and shattered the derrick. A large proportion of the first flow was saved by prompt work in digging a sump. It is said the gas pressure will be difficult to control.

The 7000-bbl. gusher of the Pacific Crude Oil Co., near Fellows, which came in on May 30, caught fire on June 2. Two 5000-bbl. tanks and another well are within 100 ft. of the blazing gusher.

Tonopah-Belmont Extensions

Special Correspondence

The recent activity of the Tonopah-Belmont Development Co., or men closely identified with it, in extending operations to other mining districts is in line with the policy being pursued by other mining companies. It was reported a few weeks since, that the company had purchased the App mine in Tuolumne County, Calif., and that considerable development and construction will be done. This mine has been idle for some years but was once a large producer.

Now comes the report that a syndicate of Pennsylvania men interested in the Tonopah-Belmont company, has taken over the control of the Pearl Lake mine in Porcupine. The management will be in the hands of the Hargraves Engineering Co., of which Col. R. W. Stevenson is managing director. Work is to be resumed immediately under the personal direction of Colonel Stevenson. A development fund of $250,000 has been placed in the treasury for operating expenses. It is the intention of the new company to carry on the work along the lines proposed by the old management. The shaft will be sunk to the 800-ft. level and a crosscut will be started from the present 400-ft. level to intercept the veins cut by the diamond drill. There are no veins of importance on the property itself, but the diamond drill showed that the veins from the McIntyre dip that way, and should enter the Pearl Lake property between 400 and 600 feet.

April Operations at Goldfield Consolidated

During April, the total production of the Goldfield Consolidated Mines Co., was 28,360 tons of ore, containing $610,708, an average of $21.53 per ton. Of this, 27,928 tons were milled with an extraction of 93.77%, and 432 tons were shipped, averaging $28.60. Net recovery from all ore was $20.20 per ton. Net realization was $392,056, or $13.81 per ton. New development totaled 3369 ft., and operating costs were $6.53 per ton, including a construction charge of 25c. Secretary Howe reports a discovery in a crosscut from the 1300 level of the Grizzly Bear workings, which he says is believed to be the downward extension of the base orebody exposed on the 1000 level of the Clermont. The showings in the Mohawk Combination and Laguna are reported satisfactory.

Operations at Chino Continue Despite Labor Trouble

Special Correspondence

On May 28, the steam-shovel crews of the Chino Copper Co., at Santa Rita, N. M., presented a petition, asking for an increase in wages and requesting an answer by June 1. While the matter was being given prompt consideration by the management, the latter learned that two of the leaders had busied themselves with the trainmen, even to the extent of calling some of them out of bed at night to persuade them to join in a demand for an increase in wages. This fact became known to the management, and on the morning of May 29, these two leaders received notice that their services were no longer required.

On leaving their shovel, the two discharged men visited the remainder of the crews, persuading them to quit work. On the night of May 29, a conference was held between the men and the superintendent, and the men were requested to return to work, giving the company until June 15 to consider the matter. The company assured the men that meantime nothing would be done that would in any way prejudice their positions, but it insisted on the discharge of the two leaders.

It was evident that many of the men were not in sympathy with the movement and methods used, but it became necessary, on May 30, to refuse the men's proposition. They declined to go to work until they received higher wages and were promptly given their time.

Work was resumed by the company loading ore on the morning of May 31, and mining operations have continued since without interruption. The mill has not been affected by the trouble and has been run continuously at capacity. Stripping operations have been curtailed, but as there are many months' supply of ore from which the overburden has been removed, there is absolutely no embarassment to mining operations and applications from new crews are coming in.

The movement started at the mine was without the sanction of any of the unions with which the men have been affiliated. The steam-shovel men are being paid wages considerably in excess of the union scale, while the trainmen's wages were equal or in excess of the prevailing rate in this section.

According to *Journal du Four Electrique*, the Oresunds Chemische Fabrique of Copenhagen, which owns the cryolite mines of Greenland, in 1911 exported 6000 metric tons of cryolite as follows: to France 1600 tons, to Germany 1300, to Austria 760 tons, to England 700 tons, and the remainder to other countries.

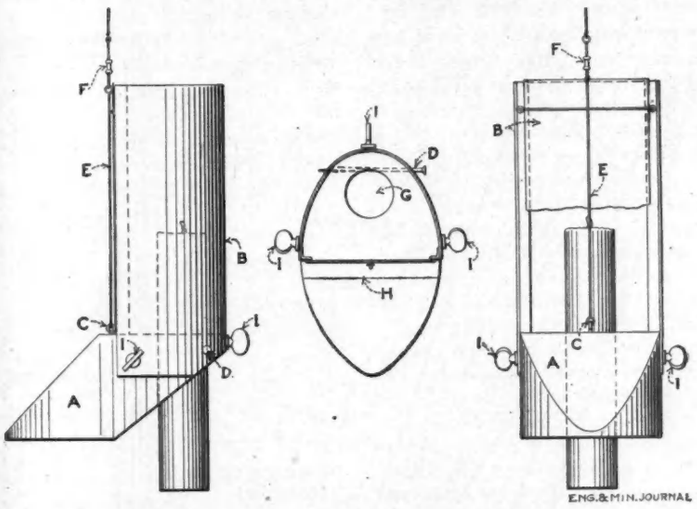
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

Surveyor's Backsight Sconce

By F. L. Fischer*

The surveyor's sconce illustrated in the accompanying sketch was designed to throw a light on the backsight in order that the plumb line might readily be seen through the instrument when surveying was being done underground. It has been proved convenient and serviceable in all conditions of air currents and hazy atmosphere in the Boston and Montana mines of the Anaconda Copper Mining Co. at Butte.



Backsight Sconce for Underground Surveys

The sconce consists of a heavy bronze or copper weight *A*, surrounded on the sides and back by a semicylindrical casing *B* of copper sheeting which extends a sufficient distance above the weight to shield the candle from the wind and to reflect its light. A screw-eye *C* is sunk in the weight above its center of gravity. One end of a stiff, steel wire *E* three or four inches long and of as small diameter as can be used to carry the sconce is attached to the screw-eye. The other end of the wire is attached to a swivel *F*, and to the swivel is tied the plumb line. A hole *G* of the same diameter as the candle is bored through the weight *A* and when the sconce is to be used a candle is thrust through this hole and a pin *D* is thrust into a hole made for the purpose to keep the candle from falling out. A piece of tracing cloth or oiled paper *H* is placed between the sighting wire *E* and the casing *B* which causes the wire to show strongly upon the background when viewed through the transit.

When the sconce is hung from the plumb line the weight and casing should remain in balance so that the candle is in an approximately vertical position. The casing and weight are both made of copper or bronze as iron might be attacked by the mine water; the former is secured to the latter by three thumb screws *I*, permitting the reflector to be readily detached for cleaning and polishing.

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Air Compressor Lubrication

Explosions within the cylinders of an air compressor are usually caused by the ignition of inflammable gas, the presence of which is due to the use of too much lubricating oil of low flash point. The heat liberated from the air during compression may cause vaporization of the oil and the vapor mixing with the compressed air forms an explosive mixture that may be ignited at the temperature attained by the air in the cylinder.

Excessive use of oil is open to the further objection that oil tends to cause sticking of the valves. Ordinarily, air cylinders and pneumatic tools require less oil than steam cylinders.

A lubricant that is free from the above mentioned objections to the use of oil is soapy water, with which a small quantity of flake graphite has been mixed. The flakes of graphite remain suspended in the water until admitted to the interior of the cylinder, where they exhibit a tendency to attach themselves to the metallic surfaces, imparting a superficial glaze that is smooth, acquires a high polish and prevents actual contact of metal with metal. A small quantity of the mixture provides a safe and sufficient lubricating layer.

As the soapy water may cause rusting, it is advisable to introduce a little oil into the cylinder when shutting down the compressor. The graphite is not affected by any degree of heat attainable in a compressor cylinder; it will not be carbonized or baked into a hard or gummy mass to interfere with the action of the valves, and under no conditions can it be volatilized.

Surveying a Raise Connection with Transit

By H. Y. Russell*

Several years ago I made a survey for a connection between the workings of a large mine in Colorado; some of the results obtained may be of interest.

The workings were in two counties separated by a high divide, and were worked through two tunnels the portals of which were about three miles apart. The drifts to be connected were on the same vein, one being 660 ft. above the other. The vein dipped at a grade of 10 in 100 ft., and the company decided both to sink and raise on the vein to make the connection.

Seven Mile Survey Between Workings

With the site of the collar of the shaft chosen, it was then necessary to run the survey lines out of the upper workings, over the divide and into the lower workings to determine the point at which the raise should start. The surveyed distance was approximately 35,000 ft., or about six miles. The point where the survey line crossed the divide was 2800 ft. higher than the lower workings. The instrument used was a C. L. Berger mining transit reading to minutes, telescope about 8 in. long, and equipped with a complete vertical circle.

As it was necessary to determine the vertical distance between the drifts, the vertical angles were read and the height

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of instrument was noted at each set-up. The sighting was done to tack heads and the distances between the tacks and the hub of the instrument were measured. The horizontal and vertical distances were then calculated.

Except the actual work of surveying, the greatest difficulty was to go over the divide, which was a rounded hill covered with slide rock so loose that it was almost impossible to place the instrument where it would not move should anyone come within 10 ft. of it; survey stakes moved in the same way. The divide was so rounded that there was no place at which the instrument could be set from which bases for triangulation on each side of the divide could be seen. It was, therefore, necessary to get up in the slide rock several times to carry the line across the divide.

After some experimenting, it was found that a 25-ft. pole on the divide could be seen from base lines on each side. The base lines were about 3800 ft. from the pole and 1500 ft. below it; they were about 1200 ft. long. As it was impossible to set up at the apex of the two triangles, the horizontal base angles were quadrupled to eliminate error as far as possible, and the vertical angles from the bases to the pole were repeated several times.

In order to carry the bearing over the divide, direct solar observations were taken at 9 a.m. and 3 p.m. of the same day on each base, the instrument being reversed at each observation in order to compensate errors. These observations checked to a minute. This made the whole operation really two surveys, one from the bottom of the raise to the pole, and the other from the collar of the shaft to the same point. Except for the triangulation, the survey consisted of turning the angles and measuring the distances. The underground work was checked by the regular mine surveys that had been made from month to month. In the underground work the vertical angle and the height of instrument were taken and the slope distance measured. The three miles of outside surveying were done in two days, the same distance underground in five days. The mine work was not interfered with at all.

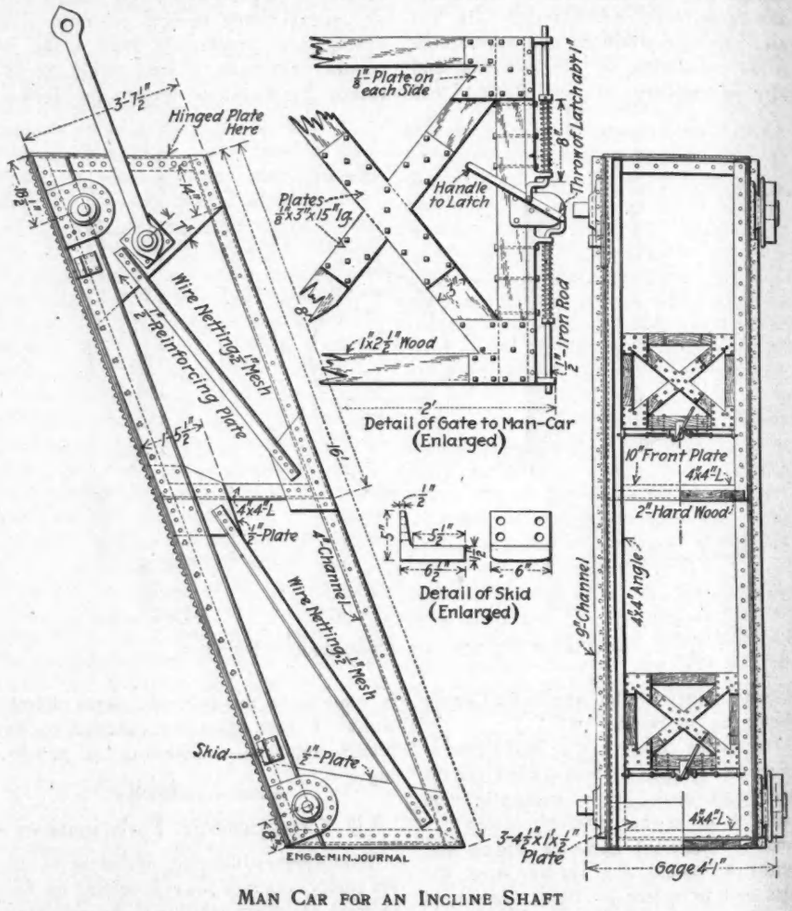
Bad Air In Making Connection

After the shaft, which was 8x5 ft. and roughly timbered, had been sunk 100 ft., a strike was called by the miners in that county, causing a shutdown, and as there was no natural ventilation, the workings on this side of the divide filled with bad air and became inaccessible. Before the raise was holed through about eight or nine feet of water gathered in the bottom of the shaft and a peculiar accident was barely averted. The raise to the shaft was started 8x4 ft. in the clear, and after it had been carried up a certain distance was made smaller. When it reached 450 ft., the men drove a small drift from the raise, into which they would go after the fuses had been snuffed to wait in safety until the round had exploded. Careful measurements were kept and the men informed as to the distance necessary to connect. With five or six feet to go, the top of the raise was but slightly damp, and there was no suspicion that there might be water in the shaft, the vein being a dry one. When the last round was fired, the crew were sitting comfortably in this drift. The water rushed past harmlessly, but it sucked behind it a quantity of bad air, which threatened for a time to suffocate the men. The air current fortunately changed quickly and good air from below came up in time.

When the loose ground was cleared away from the connection it was found that the raise had come through in the center of the bottom of the shaft. It was also found that the distance actually raised agreed with that determined by the vertical angles and the height of instrument to within 12 inches. Time can be saved by using the transit in this way for leveling, and I think it will be used more often than it now is when the accuracy of a good transit and the way errors compensate are realized.

A Copper Range Man Car

The man car used for lowering and raising men at the mines of the Copper Range Co., in the Michigan copper district, is shown in the accompanying illustration. This skip is designed for use in a shaft sunk at an inclination of 70° from the horizontal. It is a two-deck car, and there is room for 13 men on each deck. The sides of the car are covered with ½-in. mesh wire cloth, and the front is closed by gates, one for each deck, that slide in channel guides, a set of which is provided for each gate at the front of the car. The gates may be locked in position above the men's heads, or waist high by throwing the lever which pushes two rods out through holes in the channels provided for the purpose.



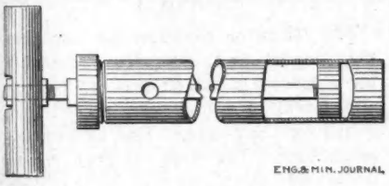
MAN CAR FOR AN INCLINE SHAFT

The flooring of the upper deck is held in place by two pairs of channels, between which it slides, so that it may be removed when timbers are to be lowered. The lower parts of the gate guides are also cut away, so that the gates can readily be removed when the car is to be used for this purpose, and a bolt that hooks into eyes on each side of the car just below the upper deck, and which prevents spreading or bulging at the sides, can likewise be removed to make room for the timbers.

A hood is used at the top of the car and is hinged so that it may be laid back when 30-ft. rails are to be lowered. In order to prevent accidents that might occur if one of the wheels should break while the skip is in motion, two pairs of skids are attached to the under part of the body, which, in the case of such breakage, would support the car upon the rail.

Cartridges for Tamping Dynamite

The article on making cartridges for tamping dynamite published in the JOURNAL of May 4, 1912, suggests a simpler method of procedure, but a more elaborate although simple device is required. The device consists of the molding-tube illustrated in the accompanying sketch. It is made by threading one end of a 9-in. piece of brass tubing of suitable diameter. The bore of the tube is fitted with a plunger tapped to take a 10-in. rod about ¼ in. diameter. The other end of the rod is threaded and attached to a handle by two flat nuts as shown. The threaded end of the brass tube is closed by a cap through which the plunger rod passes as shown in the sketch. A hole ¼ in. diameter is drilled in the side of the brass tube one inch below the cap.



DEVICE FOR MOLDING TAMPING CARTRIDGES

This tube, a small planed board, a few newspapers, and a batch of moist, fine dirt are all that is required to make neat cartridges that will give no trouble in tamping a drill hole. The newspapers are cut into strips 10 in. wide by 8 in. long. The plunger of the molding tube is withdrawn to the cap end and the bore is packed with the moist dirt, the ¼-in. hole at the cap end permitting the air to escape. When the bore has been filled the tube is stood upright upon the planed board and the plunger is pressed down to compact the dirt into a cylinder; the tube is then laid upon its side and the cylinder removed from the tube by pushing on the plunger handle, so that the ejected cylinder of dirt lies upon a piece of the newspaper laid smoothly upon the planed board. To complete the cartridge it is only necessary to roll it up in the paper and fold over the ends.

These tamping cartridges should be carefully placed side by side in an empty powder box as soon as made, and when needed, the box of cartridges is carried to the place where blasting is to be done. As all the cartridges are of uniform size no trouble will be experienced in placing them in the drill holes if the tube is of the proper diameter for the size of hole in which the cartridges are to be used.

Drying Air in a Mine Telephone

BY L. H. EDDY

The South Eureka mine at Sutter Creek, Amador County, Calif. is equipped with four surface telephones and eight underground mine-a-phones. The superintendent's office, the engineer's platform, the master mechanic's shop and the sawmill are directly connected by telephones with the eight working levels at the following depths: 1600, 1800, 2000, 2100, 2300, 2400 2500 and 2730 ft. The cable used in the mine is a duplex lead-covered No. 16 copper wire. This cable is carried in a 1¼-in. gas pipe and brought out through tees at each station. This pipe carries also a duplex rubber-covered cable of No. 6 copper wire brought out through the same tees for electric lighting at each station, and carrying 100 volts. The telephone cable is so arranged that it can be cut out from station to station to facilitate the locating of any trouble that might arise in the line.

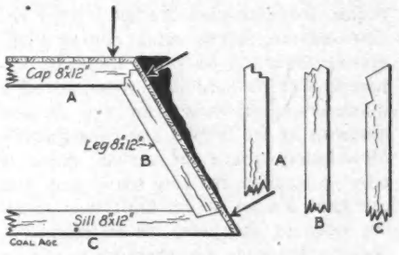
The instruments are of the Stromberg-Carlson type. When first installed trouble was experienced from the effects of the hot, damp air of the mine, which would cause the carbon in the transmitter to swell so that it would not operate. This trouble has been overcome by drilling a hole in the side of the cast-iron telephone box and putting a weatherproof lamp-socket, with a 4-cp. 100-volt lamp inside the box. This lamp gives off sufficient heat to keep the telephone dry. The lamp is connected to the lighting circuit.

The Utica mines at Angels Camp, Calaveras County, Calif., and other mines on the Mother Lode, also use the underground telephone. The only disturbance, that I have observed, caused by damp air or water other than that at the South Eureka, was the rusting of the hinges of one of the boxes in the Cross shaft of the Utica mines. I could not learn positively whether this rusting resulted from the effect of the damp air or dripping water, but evidently the indirect cause was the neglect of the attendant to keep the hinges properly oiled. A mechanic at the mine suggested that a copper or brass pin be substituted for the iron pin in the hinge. Another suggestion was that the hinges and pins be made of bronze. Still another suggestion was that the attendant should be obliged to keep the boxes in order and prevent rusting, as in the care of other equipment. The last suggestion may be objectionable on the ground that it is not possible always to secure careful attention to details of this sort from the class of labor that must be depended upon, and the labor of electricians and mechanics is considered too valuable to be taken up in this way. The interior of this telephone box was not affected, but its usefulness was destroyed by the rusted hinges. It is quite probable that the new box displacing the old one was set in a position where the water or the dampness would not affect it, but even this precaution cannot always be taken, as a dry spot today may be a wet spot tomorrow.

The telephone equipment at the mines mentioned and all others coming under my observation during a recent visit in the Mother Lode region in the three principal counties were reported to be giving complete and satisfactory service. The surprising feature of the observation was that many of the deep mines are without underground telephone equipment.

Joint for Drift Timbers Subject to Side Pressure

The joint for framing the legs into the cap of a three- or four-piece drift set, shown in the accompanying illustration,



AN IMPRACTICABLE JOINT

is designed to give equal areas on the ends of both cap and legs to resist both downward and side pressures. This joint would meet the requirements if it could be cut perfectly. It is, in practice, almost impossible to cut this joint so that all areas of the cut in the cap will bear evenly on all corresponding areas in the leg cut. For this reason the joint is not favored by experienced timbermen.

A simpler and more effective joint can be made by bringing the ends of the legs to bear under the end of the cap in which no notch at all is cut, then to the under side of the cap, a piece of timber is spiked, the ends of which bear against the upper ends of the legs immediately below the cap. This piece of timber resists the side pressure exerted against the legs, the cap, in-so-far as side pressure is involved, serving only to carry this piece of timber.

The joint shown in the sketch is liable to result in splitting of the timbers in those places where the wavy shade lines are drawn.

Long Core Barrels for Vertical Boreholes*

By John I. Hoffman†

About two years ago two boreholes were completed on the Rand, special precautions being taken to keep the holes plumb. One of the holes was put down by the Lace Proprietary Mines on the farm of Vlakfontein in the Heidelberg district of the Transvaal, and the other to the south of the Brakpan Mines property, on the portion of Witpoort No. 162 belonging to the South African Lands & Exploration Co. Both holes were put down by the same contractor, William Gallagher, of Johannesburg.

Special core barrels were made having an outside diameter exactly the same as the outside diameter of the crown, but these core barrels were made 30 ft. long instead of 10 ft. as usual, so that there was practically a rigid rod 30 ft. long extending from the cutting face of the crown to the junction of the core barrel with the drill rods. As a rule the core barrel is only a little larger than the rods which, in the case of a Sullivan "B" drill, measure 1⅞ in. outside diameter, whereas the outside diameter of the crown measures from 2 in. to 2⅛ in. before the diamonds are set. After the diamonds are set the actual cutting diameter is about 2⅛ in. It is therefore apparent that the ordinary rods are of a diameter ¼ in. less than the cutting diameter of the crown, and consequently immediately above the crown, which is only ¾ in. deep, the core barrel and rods can cant almost ⅛ in. until they touch the sides of the hole. It is, therefore, obvious that once any pressure is put on the crown the flexibility of the rods will allow them to cant against the side of the hole, and consequently there will be more pressure on the crown on the side of the hole to which the rods have canted than on the opposite side, which is often the cause of the drill commencing to deviate from the vertical. As in the case of the two holes mentioned above, where special core barrels were used having the same diameter as the crown, there was only sufficient clearance between the outside of the core barrel and the borehole to allow the water and the cuttings to flow past, and this had the desired effect of keeping the hole plumb in the Vlakfontein borehole for a depth of 1000 ft., after which the drill commenced to deviate, probably owing to the bit entering broken ground.

In the case of the Vlakfontein borehole, the depth reached was 6656 ft. measured along the rods, which is one of the deepest boreholes in the world. Once the hole left the vertical at a depth of 1000 ft., the angle of deflection continued to increase gradually until at the bottom the hole was dipping at 58° from the vertical. From the 1000-ft. to the 2600-ft. depth the rods deflected from the vertical to 44°, but continued at more or less that angle down to 5000 ft., where the deflection again commenced to increase until at 6600 ft., the lowest depth surveyed, the dip of the hole was 58° from the vertical. The vein was cut at 6198 ft. measured along the rods, the calculated vertical depth being 4813 ft. The horizontal distance between the points where the vein was cut and the borehole commenced was 3259 feet.

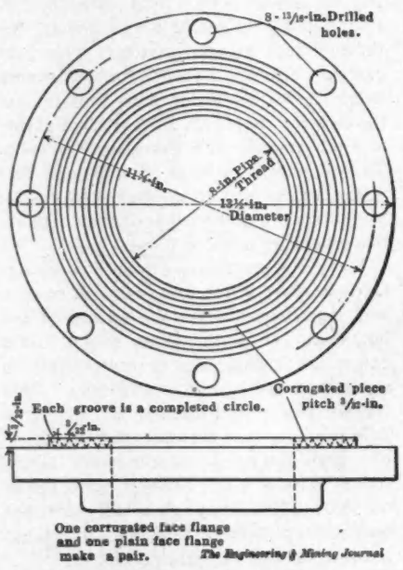
*Excerpt from a paper entitled "Recent Practice in Diamond Drilling and Borehole Surveying," Bull. 91, I. M. M.

†Mining engineer, 216 Moorgate Station Chambers, London, England.

Pipe Flanges without Gasket

By Claude T. Rice

At the Copper Range mines in Michigan the surface air and steam pipes are jointed without any gasket between the flanges, as can be seen in the accompanying sketch which shows the details of a standard 8-in. flange.



Grooved Flange for Pipes

One flange is smooth and the other corrugated. These corrugations are complete circles cut 3/32 in. deep and are 3/32 in. wide at the base. In cutting them a tool with a saw-tooth edge is used and they are all cut in the face of the flange at one time. The flanges go in pairs. A grooved flange is butted against a flange with a smooth face. The flanges are painted with a mixture of white and red lead and are brought tightly together by means of the bolts. In this way a tight joint is obtained. These flanges have been used, as yet, only upon the surface lines, but in the future they will be used on extensions of the main air lines underground. The flange was designed by W. J. Richards, the master mechanic of the Copper Range company.

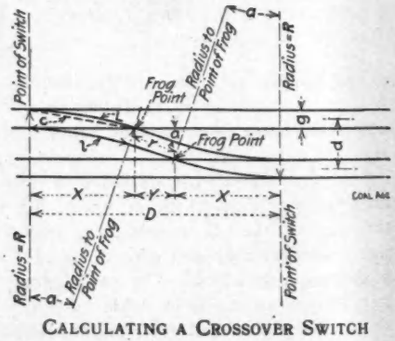
Temperature Correction Chart for Tapes

Attention has been called by F. C. Armstrong, of Boulder, Colo., to errors in the article by H. J. Rahilly, published under the above caption in the Journal of May 18, 1912, p. 982. The word add or added should be substituted where the word subtract or subtracted appears in either the text or chart; *vice versa* the word subtract or subtracted should be substituted for add or added.

Thus the corrections above the 62° abscissa in the chart should be marked "Add," those below "Subtract"; and the last two sentences in the last paragraph should read as follows: This amount will be the increase in the length of the tape in 70 ft. at the temperature of 90° F., and should be added to the tape reading. When the temperature is below 62° F. the correction should be subtracted instead of being added. It is apparent that a tape longer than standard will read too short and a short tape will read too great a distance.

Calculating a Crossover Switch

The following formulas for calculating the lengths and distances required to lay a crossover switch between two parallel tracks in a mine were recently published in *Coal Age*. The data usually given are: The frog number, *n;* the gage of the track, *g;* and *d,* the track centers.



Calculating a Crossover Switch

The data required are found by the following formulas: The chord of lead rail, $c = 2ng$; the radius of lead rail, $R = nc$; the frog angle, $\sin. \frac{1}{2}a = \frac{1}{2n}$; the length of lead rail, $L = \frac{a}{180}\pi R$; the length of the follower, $l = \frac{R-g}{R}L$; the length of straight track, $r = \frac{d - g(1 + \cos. a)}{\sin. a}$; the lead of switch, $x = R \sin. a$; the frog distance apart, $y = r \cos. a - g \sin. a$; and the distance between switches, $D = 2x + y$. The letters in the formulas refer to the dimensions specified in the accompanying sketch.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Wilfley Table Kinks

By Claude T. Rice

In the mills of the Joplin district, Missouri, it is customary to use a drip spout on the Wilfley tables, on which the finest material is concentrated, to keep water flowing down the tail edge of the table. On the tables on which the coarser material is concentrated a cleat is nailed to the table near the edge of the tail end and under the wash-water box, as shown at *A*, Fig. 1. The motion of the table causes the water to bank up at the cleat and flow down the tail edge, where ordinarily little water flows. Should the water tend to flow away from this edge, say at a distance of half the width of the table from the corner of the wash-water box, a second cleat *B* is nailed to the table which tends to deflect the water back to the edge. This cleat is nailed to the linoleum above the space occupied by the concentrates and far enough from that space so that the water will have spread out evenly below it before the band of concentrates is reached.

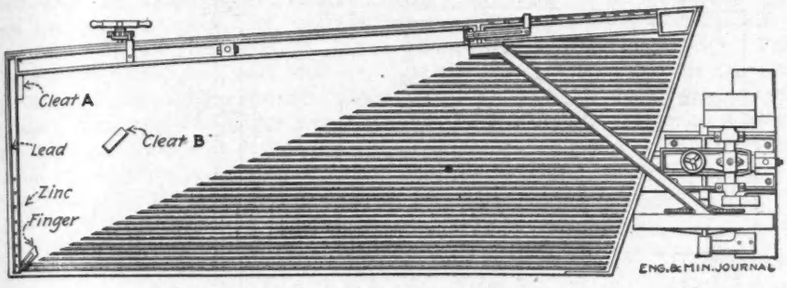


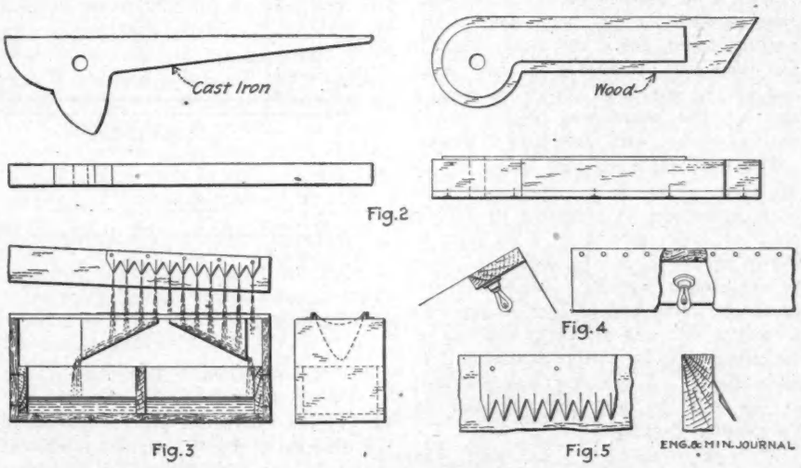
Fig. 1. Cleats and Finger on Wilfley Tables

In order to keep the line of separation between blende and middlings from coming to the corner of the table, where, in order to keep the concentrate clean, closer watching is necessary, it is the custom at many mills to use the finger shown in Fig. 2. This is bolted to the deck of the table so that it can be rotated to cause the concentrates to discharge always at the front edge of the table. This is done because if the band of concentrates works past the corner the line of separation between concentrates and middlings moves back and forth in relation to the dividing partition of the catch box a distance equal to the stroke of the table. Some of these fingers are made of cast iron others of wood with old rubber belting attached to the under side to rub upon the linoleum surface of the deck.

As the tables are used to make a three-mineral separation it is customary to provide the concentrates box with catch spouts that are supported by rods held at the tail end of the table by 2-in. pieces of wood. These sliding spouts are illustrated in Fig. 3. They are required because the line of concentrates frequently changes and with every change it is necessary to adjust the spouts so that the same character of product will always be discharged into the same catch box.

The frequent changing of the line of concentrates necessitates strong lighting of the tables at night. Therefore, a lighting trough, illustrated in Fig. 4, is hung over the tail end of the table. In the trough are several 8-c.p. electric, incandescent lamps, the sockets of which are supported upon a 2x6-in. timber which also carries two pieces of galvanized iron nine inches wide to reflect the light downward. The lighting troughs are suspended from the mill rafters.

In making a three-mineral separation it is necessary to make a sharp distinction between the bands of concentrates and middlings. If the concentrates come from the table in broad bands and the feed has not been closely classified, it is difficult to make a sharp separation between two products by using only the catch spouts. To facilitate making the separation it is the practice in certain Joplin mills to nail a notched lip or piece of galvanized iron to the tail end of the table. This lip is made as illustrated in Fig. 5, the depressions down the center of each of the Vs being made by bending the iron over a 20-d. nail. A portion of the bands of concentrates equal in width to the width of the upper end of the V is discharged from the lower end of each depression, the discharge coming off the table in several drips or streams that permit making a close differentiation between products.



Concentrates Collecting Devices and Lighting Trough for Willey Table

Detinning in Alkaline Solution

As a quick method of detinning, a recent patent of Joseph Weber (assigned to Th. Goldschmidt) advises boiling in a 20% NaOH solution to which has been added 10% $NaNO_2$. The tin dissolves as sodium stannate, which may be crystallized out by boiling, and the mother liquor used again, or the tin thrown out as oxide by sodium carbonate.

An Adjustable Drafting Board

By R. P. Wheelock*

At the Enterprise mine in Arizona, a drawing board 6 ft. long by 3 ft. wide was used, which when placed upon a table in the center of the room not only occupied a large portion of the limited office space, but its size made it necessary for the draftsman at times to work either in a half recumbent and therefore cramped position upon the board or to work from two or more sides. This board was subsequently mounted as shown in the accompanying sketches.

The two upright supports were each made of a piece of ¾-in. pipe, a tee, a short nipple and half of a flange union. These supports in the sketches are lettered *A* and *A'*. The shelf *M* is a piece of 2x4-in. Oregon pine 6 ft. long. A hole of the proper size to permit the insertion of a 1-in. nipple 3 in. long was bored through the shelf on the center line of the 4-in. faces 1 ft. from each end. A coupling *L* was screwed to each end of each inserted nipple, bearing tightly upon the wood to hold the nipple securely in place. The insides of the nipples and the outsides of the uprights *A* and *A'* were dressed with a file and emery cloth until the nipples easily slipped the full length of the ¾-in. pipe. Three 1x4-in. pine cleats, each 2 ft. long, were screwed to the under side of the drafting board, one at the center, each of the other two centered 6 in. from each end of the board as shown in Figs. 2 and 3. The board was hinged to the shelf as shown, with three 4-in. T-hinges.

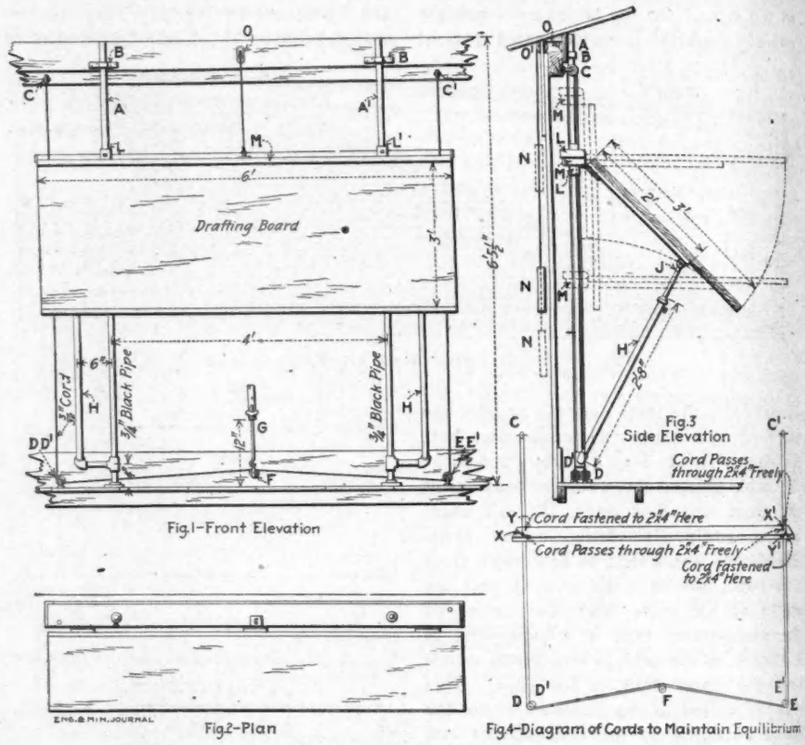
The legs, *H*, were also made of ¾-in. pipe, 2 to 8 in. long, and were made extensible by inserting in each a piece of ⅜-in. pipe 2 ft. 6 in. long as shown at *J*, Fig. 3. To secure a closer fit and greater stability a cap was screwed on the upper end of each of the legs *H*, and a hole was drilled in this cap of the proper size to permit extension *J* to move freely. A setscrew was provided in the legs, to hold the extension in the position desired.

A ¾-in. nipple 4½ in. long was screwed tightly into each tee on the uprights *A* and *A'*, and on the outer end of each nipple an ell was screwed loosely to provide for the movement of the legs. Into these ells the legs *H* were tightly screwed. Into the upper end of each extension *J* a piece of brass rod about 2 in. long, flattened on the upper end was inserted and pinned in place. This provided for hinging the extension to the end of the cleat as shown in Fig. 3. The rest of these hinges are merely to support a piece of light strap iron for each hinge screwed to the cleat, the end of the strap iron being turned up about one inch and rounded off on the corners; the flattened end of the short brass rod is inserted between the two turned up ends and a pin put through the straps and iron.

The board is counterweighted by a cord attached to the shelf on the center line and as near the front edge as possible to counteract any tendency for the weight of the board to tip the shelf forward and make it bind on the uprights. This cord passes over sash pulleys *O* and *O'*, set in the wall, and suspends a weight hung outside the building. The other cord shown in the sketches serves to keep the shelf level lengthwise and also prevents it from binding on the uprights; it is an endless cord passing over six 1¼-in. screw pulleys as shown in the diagram in Fig. 4. Opposite sides of the cord are fastened to each end of the shelf, the other side passing through holes bored for the purpose. The small double pulley *F*, and screw *G*, are for convenience in taking up any slack in the cord due to stretching.

A strip of molding was tacked on three sides of the shelf extending about ¾ in. above its surface to prevent instruments from being knocked off. Such screws are put in the couplings *L* and *L'* so that the board can be clamped in any position desired, but these are not essential as it was discovered, after the board was mounted and properly counterbalanced, that although some pressure exerted on the front side of the board would suffice to move it to any position desired, there was still sufficient friction to keep it in any chosen adjustment while subject to ordinary use without resorting to the set of screws mentioned.

*Superintendent, Enterprise Mining, Reduction & Improvement Co., Kingman, Ariz.



Adjustable Drafting Board Supported by Pipe and Fittings

Grooved Idlers for Flanged Conveyor Belts

A conveyor belt with flanged sides like the belt of a Frue vanner, was formerly used at mill No. 3, of the Doe Run Lead Co., at Rivermine, Mo., for conveying heavy lead concentrates from the bins to the railroad cars, in which they were shipped to the smeltery at Herculaneum. A flanged belt was used because it was believed that a trough belt would cause annoyance by spilling some of the concentrates if loaded when a little too wet. The flanged belts are more expensive, and, as they last but little longer, trough belts were substituted.

While using the flanged belts, it was found that the bottom or return idlers that supported the belt caused considerable wear on the inside face of the flanges. In order to support the flanges and do away with the cause of this wear, a narrow idler with a groove in the face, of the same depth and shape as the belt flange, was placed on the idler shaft at the outer sides of each pair of idler pulleys. The grooved idlers were not keyed to the shaft, as were the plain idlers, and could move a little laterally, thus accommodating the irregularities of the slightly warped flanges. Larger idlers proved unsatisfactory when applied at the drive wheel.

The Cost of Doing Things

Data from Mining and Metallurgical Practice

Unit Costs at Oriental Consolidated in Chosen

At the Oriental Consolidated Mining Co. in the Wunsan district, Chosen, Asia, the average dynamite consumption at the principal mines of the company, as shown by a two-year record, is one pound for every 3.02 tons of ore produced. At the Tabowie mine, 3.19 tons are produced per pound of dynamite used; Taracol mine, 3.24 tons; Kuk San Dong North mine, two tons; Kuk San Dong South mine, 2.83 tons; and at the Chintui mine, 4.09 tons of ore. During the same period, new drill steel for the mines averaged one pound for every 10.6 tons of ore. At the individual mines the production of ore per pound of steel was as follows: Tabowie, 10.9 tons; Taracol, 17.8 tons; Kuk San Dong North, 6.1 tons; Kuk San Dong South, 6.7 tons; and at the Chintui, 9.9 tons of ore.

Of the cyaniding expense, cyanide is about 3.7 lb. per ton of ore treated, zinc 1.39 lb. and borax 0.36 lb. per ton. Approximately one assay is made for every 9.05 tons of ore mined and treated. Oil used in the cyanide mill is as follows: one gallon of engine oil for every 182 tons, and one gallon of cylinder oil for every 376 tons. The quantity of other oils used is not given in the annual reports.

Tamarack Costs

From 1906 to 1910, inclusive, the average yield in copper per ton at the Tamarack Mining Co.'s mine, in Michigan, was 20.9 lb., and the production cost 15.2c. per lb. of refined copper. The 1911 annual report shows that the yield for the year was 19.1 lb., and the cost 15.56c. per lb. Mining, transportation to the mill, stamping and taxes cost for the last four years: 1911, $2.69 per ton of ore stamped; 1910, $2.67; 1909, $2.44, and 1908, $2.57 per ton. The cost per pound of refined copper at the mine and mill, excluding construction, in 1911, was 14.07c.; construction, 0.06c.; smelting, freight on bullion, commissions, eastern office expenses, etc., 1.23c., and interest, 0.20c. per lb. The cost of development work is included in the mining cost and is not given separately, the development work amounted to 1790 ft. in 1911, compared with 2216 ft. in 1910. Hand sorting of ore is practiced at the Tamarack, as is the case at most of the Lake Superior copper mines; 18% of the ore hoisted in 1911 and 22.1% in 1910 was discarded.

From 1906-1910, inclusive, the Tamarack produced 58,314,188 lb. of copper from 2,792,830 tons, yielding 20.9 lb. per ton. The total receipts were $8,737,089, not including receipts from the sale of lands, and the total expense amounted to $8,862,878, showing a loss of $125,788. In 1906, a profit of $413,990 was made on operations, so that during the four-year period, 1907-1910, the property was operated at a loss of $539,778. The average cost of production for the five years was 15,.2c. per lb., of which 14.4c. was for mining, transportation, milling, smelting and selling, and 0.8c. for construction and other expenses.

Anaconda

The annual report of the Anaconda Copper Mining Co., for the year ended Dec. 31, 1911, shows that $14,493,823 were expended for mining and development. The mines produced 3,844,070 tons of ore and 4602 tons of precipitates, which would indicate a mining cost of about $3.77 per ton. Transportation charges on company's ores from mines to the reduction works amounted to $1,242,286, which is equivalent to approximately 32c. per ton, if all ore produced was shipped from the mines. The reduction works treated 4,225,813.78 tons of ore, consisting of: 3,756,235 tons of ore from the company's mines, 499,077 tons of purchased ore and 501.4 tons of precipitates from old works.

The reduction expense is reported as $7,744,570, or $1.82 per ton treated. The cost of transporting metals to the East, refining, selling, administration and interest charges amounted to $4,002,673. Based upon the copper contents of the ore, this is equivalent to 1.54c. per lb. of copper.

The total production from all ores treated was 259,407,093 lb. of copper, 9,731,561 oz. of silver and 48,949 oz. of gold, these figures include the production from purchased ores. The actual yield of the ores from the company's mines is not given, but based upon the total yield of all ores treated, it was approximately 61 lb. of copper, 2.29 oz. of silver and 0.0115 oz. of gold per ton of ore. From these figures, the cost of production from the Anaconda ores may be estimated as follows: Mining, $3.77; transportation from mines to reduction works, 32c.; and treatment at reduction works, $1.82; making a total of $5.91 per ton of ore, or 9.7c. per lb. of copper. To this must be added 1.54c. per lb., as mentioned, for transportation, refining, selling, etc., making the total cost 11.24c. per lb. of copper. Figuring gold at $20, and silver at 50c., the value per ton for these metals is about $1.38, or 2.26c. per lb. of copper, which would make the net cost of producing copper from its own ores about 9c. per lb. on this basis.

Copper Range Costs

The Copper Range Consolidated in the Lake Superior copper district operates the Baltic, Trimountain and the Champion mines. According to the annual reports the costs have been as follows: At the Baltic mine during 1911, 696,795 tons of rock were stamped at a total cost of $2 per ton, consisting of $1.71 for mining, transportation, and milling; 20c. for smelting, refining, freight and marketing; and 9c. for taxes and interest, of which taxes were 8.7c. The net yield per ton of rock stamped was 22.06 lb. making a cost of 9.1c. per lb. of copper. Of the total rock hoisted 8.37% was discarded as waste. Mining charges amounted to $1.28 per ton, which includes 10,512 ft. of drifts and crosscuts, equal to one foot for every 66.2 tons of rock stamped, and 609 ft. of shaft sinking. Labor constituted 76% of the mining cost; rockhouse expense 3.7%; hoisting 4.5%; power drills 4.8%; and powder and supplies 11%. Based upon the total tons hoisted the mining cost was $1.17 per ton. In addition to these charges the surface expense including legal, insurance and general, amounting to 12c. per ton must be added, making the total cost at the mine, $1.29 per ton of rock stamped. Transportation of rock to mill was 14c. and stamp-milling expense 18c. per ton. Credits for rents received were about one cent per ton stamped.

The average cost of producing copper at the Baltic during a five-year period 1906-1910 was 8.9c. per lb.; and in 1910, 8.36c. per lb. with mining, transportation and milling $1.58 per ton and the net yield 22.4 lb. The 1911 costs include $46,955 for new construction which is equivalent to 0.36c. per lb. of copper, the average for the five years previous was 0.64c. per pound.

The Champion mine hoisted 787,416 tons of which 6.7% was discarded by sorting and 734,392 tons stamped yielding 21.29 lb. of copper per ton at a cost of 9.6c. per lb. Mining, transportation, and milling was 8.2c. per lb.; smelting, re-

fining, freight, marketing and general expense, 0.0885c.; and taxes 0.57c. per lb. Mining was $1.19 per ton hoisted or $1.28 per ton mined, of which labor was 74%; rockhouse expense 4.2%; hoisting 4.1%; power drills 5.5%; and timber and supplies 12.5%. Included in these costs is one foot of drifts and crosscuts for every 66.7 tons of ore stamped, and 689 ft. of shaft sinking. In addition to the mining expense as stated, 12c. must be added for surface expenses, making the total cost at the mine $1.40 per ton stamped. Transportation of rock to the mill was 14c. and milling 23c. per ton with credits of about two cents for rents received.

From 1906-1910 inclusive the average cost of producing copper at the Champion was 9.25c. per lb. and in 1910, 7.86c. with mining, transportation and milling $1.76 per ton on ore yielding 26.6 lb. per ton. The 1911 costs include $46,805 for new construction which is equal to 0.294c. per lb. of copper. The average cost for construction during the five-year period was 0.85c. per pound.

At the Trimountain mine 6,120,417 lb. of copper were produced from 347,885 tons of sorted ore yielding 17.59 lb. of copper per ton at a cost of 11.55c. per lb. made up as follows: Mining, transportation and milling, 10.35c.; smelting, refining, freight, selling and general expense 1c.; and taxes 0.2c. per lb. Of the total tonnage hoisted 11.4% was discarded as waste. The cost of mining was $1.22 per ton of rock hoisted and $1.39 per ton of sorted ore, of which labor was 67.3%; rockhouse expense 4.4%; hoisting 7.7%; power drills 7.9%; and powder and supplies 12.7%. Included in this cost was 525 ft. of shaft sinking and one foot of drifts and crosscuts for every 48 tons of rock hoisted or 42.5 tons of sorted ore. The surface expense at the mine including insurance, legal and general, was 17c. per ton, making a total of $1.56 per ton at the mine. Transportation to the mill was 11c. and stamp milling 17c. per ton. Rents received gave a credit of 3c. per ton.

The average cost of producing copper at the Trimountain from 1906-1910 inclusive was 12.8c. per lb. with mining, transportation and milling $1.91 per ton and rock yielding 18 lb. of copper. In 1910 the cost of mining, etc., was $1.90 per ton and the cost of producing copper 12.2c. per lb. The 1911 costs include $37,012 for new construction which is equal to 0.6c. per lb. of copper. During the five-year period mentioned construction cost 0.43c. per lb. The average cost for all three of the properties was 9.74c. per lb. for 1911 but the Copper Range Consolidated only receives one-half of the production of the Champion mine. The general expenses of the Copper Range Co. amounted to 0.28c. per lb. and earnings from the railroad 0.18c. making a net charge of 0.045c. per lb. additional for the company as compared with the Champion costs.

Calumet & Arizona Costs

The Calumet & Arizona Mining Co., operating at Warren, Ariz., states that the cost of producing copper was 7.34c. per lb. The cost may be constructed as follows. By charging $53,445 spent on outside properties, as charged to profit and loss, to operations will make 8.56c. for operations which include all expense at the mine and smeltery, freight, refining, marketing and general expenses. A credit of 1.2c. per lb. of copper for the gold and silver contents will reduce the operating charge to 7.36c.; to which a charge of 0.18c. per lb. must be added for construction as reported. This will make the total cost of producing copper, 7.54c. per lb. Credits from miscellaneous sources amounting to $57,411 are reported, equal to 0.11c. per lb. which will reduce the net charge to 7.43 cents. By charging the money spent on outside properties to operations, the account is treated in the same way as explorations are by a great many companies, particularly the iron-mining companies of the Lake Superior region.

An average of 1382 men were employed during the year; 562 at the Calumet & Arizona mine; 344 at the Superior & Pittsburgh and 476 at the smeltery; at the former mine 435 dry tons per year were mined per man; and at the latter, 596 dry tons; the average for the two was 496 tons of ore mined per year per man. At the smeltery about 950 dry tons including fluxing ore were treated during the year for every man employed. At the Calumet & Arizona mine 10.1 wet tons of ore were mined for every foot of development work performed, compared with 11.2 tons during 1910. A dry ton was equal to 92% of a wet ton. At the Superior & Pittsburgh a dry ton was 94% of the wet weight and in 1911 9.1 wet tons were mined for every foot of development.

Unit Labor Costs for Michigan Cement

According to the mineral statistics of the State of Michigan for 1908, there were 16 portland cement plants in operation, producing 3,210,347 bbl. of cement, which is equivalent to approximately 610,000 tons. The average number of men employed by all the companies was 1878, which indicates an average annual output of 1710 bbl., or approximately 325 tons of cement per man employed. The figures in the report are official, being submitted by the managers in charge of the works; the average annual barrels secured per man varied considerably. The lowest output was by a plant producing 25,000 bbl., at an average of 311 bbl. per man. The highest was by a plant with an output of 210,000 bbl., at an average of 2800 bbl. per man. The largest output by any one plant for the year was 380,726 bbl., but the average was only 1260 bbl. per man employed. The second highest average was at a plant producing 350,000 bbl., at an average of 2520 bbl. per man per year.

Robinson Mine, Transvaal

The 1911 report of the Robinson Gold Mining Co., Ltd., states that 710,000 tons (2240 lb.) were mined at a total cost of $1.80 per ton, which includes the cost of delivering the ore to the crusher; this cost is made up as follows: 59c. for stoping; 8c. for timbering and rockwalling stopes; 24c. for old workings; 4c. for sand filling stopes; 32c. for shoveling in stopes and tramming underground; 39c. for miscellaneous charges and 14c. per ton for development. The development cost per ton of payable ore exposed by driving amounted to 34.3c. per ton. Of the total ore mined, 117,600 tons or 16.6% of the ore mined was discarded by hand sorting.

The mill treated 592,700 tons in 315 days with 250 stamps at the rate of 7.5 tons per stamp per day. The average value of the ore crushed was 11.19 dwt. gold per ton, 68.4% of which was extracted before cyaniding. Of the total tonnage crushed 99% was converted into pulp and treated in the cyanide plant. The average assay value of these heads was 3.53 dwt. and residues 0.531 dwt.; the actual yield was 3.18 dwt. per ton, making a theoretical extraction of 84.9% and actual 90.2%. The extraction by the cyanide department by actual yield was 28.3% of the total gold contents of the ore.

The total cost of reduction per ton was $1.05, made up as follows. Ore sorting and crushing, 15c.; transport to mill, 6c.; stamping and milling, 27c.; tube miling, 14c.; cyaniding, 43c. per ton. Based on the tonnage milled the working costs were as follows: Mining, $2; development, 16c.; milling, $1.05; general expenses, 35c.; a total working cost of $3.56 per ton. The capital expenditures amounted to approximately 38c. per ton, bringing the actual cost for the year up to $3.94 per ton. Of the men employed 423 were whites, 66 Cape boys and Indians, and 2974 natives or a total of 3463 employees, which is equivalent to about one man for every 205 tons of unsorted or 171 tons of sorted ore per year.

Power Costs at Baltimore Copper Works

In testimony recently given before the Public Service Commission of Maryland, it was brought out that power is furnished to the Baltimore Copper Smelting & Rolling Co. at ½c. per kw.-hr. The revenue derived from the copper works by the Consolidated Gas, Electric Light & Power Co. was stated to be about $125,000 per year. Power is furnished by the Falls of the Susquehanna.

Cyaniding at Nova Scotia Mill

By C. L. Hargrave*

The conglomerate ore of Cobalt is highly refractory, the silver occurring chiefly as sulphides and antimonides. The treatment at the Nova Scotia mill, before the shutdown, included rough concentration, pan-amalgamation of concentrates and cyanidation of all tailings. Reducing agents interfered with extraction and precipitation. Close concentration and the use of electrolytic oxygen suggested as remedies.

*Mining engineer, Phoenix, Ariz.

Owing to the recent forced shutdown of the Nova Scotia mill, a brief review of some troublesome features of cyanidation here may, at this time, be of general interest to cyanide operators, particularly those in the Cobalt district.

Ore Highly Refractory

The conglomerate ore of this district is especially refractory, and cyanidation involves many interesting problems. Silver occurs[1] as native silver, as dyscrasite, Ag_6Sb, as argentite, Ag_2S, and as pyrargyrite, Ag_3SbS_3. The amount of leaf silver is small, most of the silver occurring as sulphide compounds. On the diabase ores of the Nova Scotia mine, however, by far the greater part of the silver is in the leaf form.

Copper also occurs in the conglomerate ores as tetrahedrite, $Cu_8Sb_2S_7$, as bornite, Cu_5FeS_3, and as copper pyrites, $CuFeS_2$. Nickel and cobalt occur as the arsenides, niccolite, NiAs, and smaltite, $CoAs_2$, and as arsenates, nickel bloom and cobalt bloom. Native bismuth and graphite are found in small quantities. The following is a partial analysis of a fairly high-grade conglomerate ore: Iron, 6.45%; sulphur, 1.15; arsenic, 3.4; antimony, 1; cobalt, 1.02; nickel, 0.87; bismuth, 0.05; copper, 0.14%; silver, 287 oz. per ton.

The policy at the Nova Scotia has always been to ship nothing but bullion, even the refractory concentrates being treated in the mill. Most operators here have hesitated to adopt this practice, and in the case of those who make use of cyanide, the mainstay in their recovery system is concentration, which, begun in the mine, is followed up so closely in the mills that they become essentially concentrators with cyanidation playing quite a minor rôle. In my opinion, the latter plan of treatment is fully justified, as I will later attempt to show.

Coarse Concentration Used

The 40-stamp mill of the Nova Scotia is a custom plant, treating ore averaging about 30 oz. in silver. The treatment consists of stamping in solution through 16-mesh screens, coarse concentration on Deister No. 2 tables and all-sliming of the table tails by tube mills. Amalgamation pans, Dorr settlers, Trent agitators, a Moore filter and Merrill precipitation presses make up the main equipment.

This treatment, while used on the diabase ores of the Nova Scotia, previous to custom milling, was said to be fairly satisfactory, but, when later it was applied to the conglomerate ore from the other mines, it did not give the expected recovery.

It will be noticed that no slimers are used, dependence being placed in the cyanide solutions to make a sufficient extraction on the tails after the first rough concentration. This proved to be the weak link in the system. Different tests which were made on the filter tailing before discharging to the lake, showed that fine concentration was absolutely required. Had the tests been made during those times when concentrates also were being cyanided, or when the filter tailing was abnormally high, the necessity for closer concentration would have been more emphasized.

The concentrate produced by the Deister No. 2 tables usually is from 1 to 1.5% by weight and run about 1000 oz. in silver. It is first pan-amalgamated, the tail reground in a tube mill and cyanided, the solution being precipitated along with the regular mill solution, and the agitation tail being filtered and discharged along with the regular slime tailing. This is the least desirable feature of the whole treatment scheme.

Quicksilver consumption and cyanide losses are extremely high, and silver recovery usually less than that at the smelteries. Besides this, as would be expected, the cyanidation of the pan tail quickly fouls the whole mill solution, charging it with rapidly accumulating reducing agents, which later interfere with the extraction on the regular mill ore. Where jigs are used, followed by close table concentration, from 80 to 87% of the silver content of the ore is removed as concentrate, and with it a high percentage of troublesome cyanicides and reducing agents.

Reducing Agents Troublesome

The quantity of these reducing agents present in the ore and the rapidity with which they go into solution in cyanide when the ore is finely ground, are the chief obstacles in the way of the successful, long-continued use of cyanide, where air alone is employed as an oxidizer. Once formed in solution, these reducing agents remain almost entirely unaffected by air, and I have forced a large excess under 5-lb. pressure through the solution for 40 hours without causing any decomposition. When fresh pulp, particularly the tube-mill feed, was added to this solution, no amount of air prevented a gradual increase of reducing agents.

Insofar as it could be carried out, the regular mill practice confirmed this, but the Trent agitators did not allow the use of as much air as is possible in a Pachuca tank. But the solution itself was aërated at almost every possible point without lowering the quantity of reducing agents.

A sample of the filter tailing, when agitated with fresh cyanide solution which was replaced with fresh solution from time to time, so as to keep the reducing agents at a minimum, was reduced in silver content about 50%, showing that the residual silver was not entirely insoluble. The mill solution, however, was inactive, and longer agitation was not a way out of the difficulty. In fact, it soon became evident that practically all the extraction made in the 72-hours agitation in the Trent agitators took place in the first tank, and that also the greater part of the total extraction by cyanide in the mill was made before reaching the agitators at all. Repeated experiments showed that, whereas a fresh solution of KCN would dissolve a piece of leaf silver in six minutes, the mill solution always required two or three times as long under similar conditions.

Using a $\frac{N}{10}$ $KMnO_4$ solution and 10 c.c. of cyanide solution, the reducing power, as defined by Clennell, varied from 0.5 c.c. to 0.7 c.c. Of this sulphocyanides made up about 70%, ferrocyanides 7% and the remainder was due to organic matter, sulphides and nitrites. Determinations made at other times showed 90% sulphocyanides in the makeup of the reducing agents. Lead acetate to the extent of 1 lb. per ton of ore was used to precipitate soluble sulphides, but, judging from the amount of KCNS in solution, it was not completely effective.

Precipitation Hindered

The precipitating action of the zinc dust was interfered with considerably by the amount of reducing agents present; also at times there appeared to be resolution of silver in the press, giving a higher tail than head. As precipitation lowers the reducing power slowly, treatment of more solution daily would have been beneficial.

[1]Report of Ontario Bureau of Mines, 1907, Vol. XVI, part II.

Another feature was prominent, the total and free cyanide were always numerically equal on the mill solutions. In other words, the K_2ZnCN_4 formed in the presses appeared to be almost immediately broken down, possibly by the action of soluble sulphides, and perhaps, to some extent, by the high amount of lime present. The zinc feed was varied from 4 oz. to as high as 12 oz. at times per ton of solution. The accumulation of copper in the mill solution, reaching at times 1 lb. per ton of solution, was another element interfering with the precipitation of the silver.

While on the subject of precipitation, I would suggest that some standardized precipitation method might be used to advantage for buying zinc dust. I have found in some tests that whereas one good lot of zinc would give 96% precipitation, another lot would give only 77% upon the same solution under similar conditions.

To partly offset the effect of some of these reducing agents, it would seem advisable to crush in water rather than in solution, as about 25% of the reducing agents in the finely ground ore is soluble in water, and by dewatering a large amount may be removed, giving better precipitation and extraction with probably only slight increase in KCN consumption.

Experiments with Oxidizers

In order to overcome the effect of the reducing agents, I experimented with oxidizers, chief of which were hydrogen dioxide, H_2O_2, ozone, O_3, oxygen, O_2, taken from a 40-gal. cylinder, and oxygen produced by electrolysis, using direct current and lead electrodes in the solution; practically identical results were obtained by using a graphite anode and sheet-iron cathodes. I tried alternating current on the solution, but at 60 cycles got no action, due probably to the high rate of alternation. All of the oxidizers proved beneficial as regards extraction, but their action on cyanide differed, as the results in the accompanying table show. Cyanide and protective alkalinity (P. A.) are in pounds per ton (2000 lb.) of KCN and CaO, respectively, and reducing power (R. P.) is shown according to Clennell's definition.

Good Results by Electrolysis

The solution after electrolyzing with direct current became quite active, and, using it on ore, considerably lower tailing was obtained than when using untreated mill solution. In making this test, newly treated solution was added to replace that decanted. Continuous use of this current would greatly enliven the solution and should give an extraction approaching that when using freshly made solutions, results which are quite satisfactory, especially on the —200-mesh overflow slime.

This —200-mesh slime, by the way, leaves the concentrating mill running from 7 to 10 oz., and, as it is well washed and ready for agitation, 1 oz. would cover the cost of treatment. This is the best field for cyanide in connection with Cobalt ores at the present time, and its future use here ought to depend largely on whether, by the regular use of the current, foul solutions can be prevented at low cost and whether the mines will continue to produce long enough to warrant the installation of a specially designed plant for this class of ore. In certain cases a small plant, treating this fine slime from several mills, should prove profitable.

I have seen the statement made in some books on cyaniding that oxidizers merely accelerate the dissolving action of the cyanide, and a longer use of air would accomplish the same results. That has not been my experience, and I think the statement does not apply to highly reducing ores. I have given an ore 150-hours' agitation, using mill solution and sampling daily. After getting a tail of 14 oz., I failed to reduce it further, but upon adding hydrogen dioxide, a further extraction of 5 oz. took place. Further addition of dioxide with long agitation failed to lower this tail. Heating of solutions has been tried both in the mill and laboratory, but discontinued from lack of good results.

To summarize: On the Cobalt conglomerate ores, close concentration should precede any and all subsequent forms of treatment and especial care should be taken in crushing to prevent the formation of the rich fine slime. Panamalgamation of the raw concentrates is not satisfactory as carried out at the Nova Scotia, and smeltery treatment is better. While cyanidation at present is unsatisfactory, by using electric current as an oxidizer, there is a promising field for it on the untreated overflow slime. A number of details should be worked out; as current is cheap and air oxidization insufficient, the subject is well worth careful investigation.

EFFECT OF HYDROGEN DIOXIDE ON UNPRECIPITATED MILL SOLUTION

Amount Solution, c.c.	H_2O_2, Per Cent.	Free Cyanide	Total Cyanide	P.A.	Reducing Power After		
					3 hr.	31 hr.	46 hr.
200	none	5.6	5.6	1.9	0.53		
200	5.0	4.1	4.1	1.8	0.48	0.27	0.25

EFFECT OF OZONE ON UNPRECIPITATED MILL SOLUTION

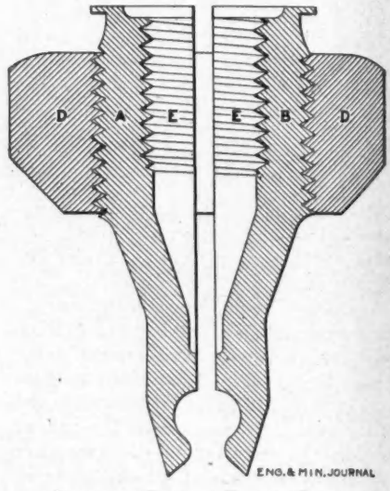
Amount Solution, c.c.	KCN.	P.A.	R.P.	Time
3000	4.3	1.4	0.55	start
	4.3	1.4	0.55	2 hr.
	3.0	0.8	0.52	8 hr.
	0.2	0.2	0.03	30 hr.

EFFECT OF ELECTROLYSIS ON UNPRECIPITATED MILL SOLUTION

Amount Solution, c.c.	KCN.	P.A.	R.P.	Time	Volts	Amperes
3000	4.3	1.4	0.54	start	4.1	0.20
	4.4	1.4	0.52	1 hr.	4.2	0.195
	4.5	1.0	0.51	10 hr.	6.0	0.19
	4.7	0.7	0.41	27 hr.	6.5	0.19

A New Mine Trolley Ear

A new suspension or ear for trolley wires in mines, which is known as Type B-3 suspension, has recently been introduced by the Westinghouse Electric & Manufacturing Co. The clamp, shown in section in the accompanying drawing, cannot be taken apart, hence none of its parts can be lost or dropped. It consists of the two symmetrical pieces



Trolley Ear in Three Pieces

A and *B*, threaded interiorly as at *E*, to receive the insulator stud and exteriorly for the nut *D*, which, upon being tightened draws the two symmetrical parts together.

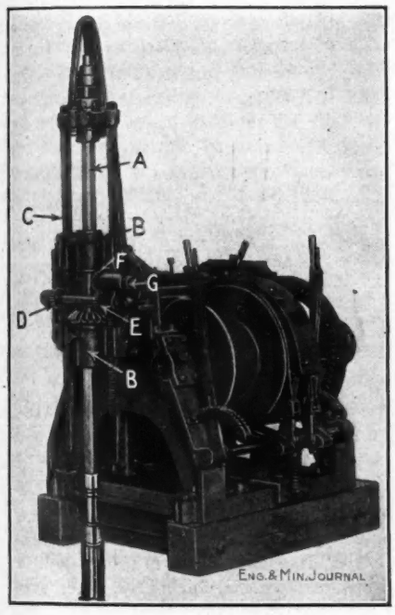
The clamp complete, with nut *D* loosened is screwed on the insulator stud, the wire is inserted in the lips of the clamp slipping freely into place without forcing, then the nut is tightened firmly clamping wire and stud. The ear can be placed in any direction and still be tight on the stud, making it unnecessary to twist the insulator after screwing the ear together. The wire can be drawn through the ear in taking up slack by loosening the nut *D*, without danger of the wire dropping out. All parts of the clamp are sherardized.

Silica in fluorspar should be determined by volatilization of silicon tetrafluoride and decomposing the vapor in water.

The Dobbins Core Drill

The design of the Dobbins core drill is characterized by many improvements upon the older types of core-cutting machines in which steel shot is used. A notable feature is the compactness of the machine. The base measures 3x3 ft., and as an inverted, two-cylinder, slide-valve engine is used, the overall height is but 47 in. The crank shaft is geared directly to the main horizontal drive shaft, and to the hoisting drum which is shown in the accompanying halftone, and which is opposite the engine.

The drill head is hinged so that it may be swung away from above the hole, a feature which permits quick clearing when hoisting or lowering tools or when driving casing. It is swivel mounted so that holes may be drilled at any angle up to 55°. Furthermore the drill



THE DOBBINS SHOT DRILL

head can be removed and the machine used as a winze hoist or for hoisting while shaft sinking, a feature which should commend it for use in prospecting, as a core drill and winze hoist are virtually combined in one machine.

The drill spindle, *A*, is square in section and slides freely in the long sleeves, *B*, *B*, on the drill head. The feed is effected by the sliding rack-guide, *C*, through the gears, *D*, *E*, and *F*. The gears, *D* and *E*, are mounted upon a short shaft and gear *E* is engaged by gear, *F*. A ratchet lever, shown in the illustration, is attached at *G*, so that a downward movement of the lever causes *F*, to move *D* and *E*, so that the rack-guide moves down. The ratchet lever can be used to apply pressure when starting holes until the weight of the rods is sufficient for cutting to continue without extra pressure. By reversing the ratchet lever the rods may be lifted and the pressure on the bit be relieved without recourse to the hoist. The spindle and guide are unusually long, 30 in., so that time is saved in less frequent additions to the drill rods.

An automatic spring tension in connection with the band brake on the hoisting drum allows for proper cutting pressure. When the brake lever is set to allow gradual slipping of the drum as the core is cut, positive and close adjustment may be obtained by occasionally tightening or loosening the spring tension.

These drills have been used by the Manhattan Drilling Co., 25 Broad St., New York, and have been placed upon the market. One machine is at present being used to drill an artesian well at the Battery Park building in New York; another is in use at the site of the new New York Central railroad station in New York. Both drills are cutting a 4½-in. core with a 6-in. bit. Drilling has been done at the rate of 59 ft. in three 8-hr. shifts; the cost is reported to be 56c. per ft. The usual type of bit, core barrel, sludge barrel and drill rods are used.

California Oil in April

The net production of petroleum in all California fields in April was 6,810,953 bbl., a daily average for 30 days of 227,032 bbl. This is a decrease in total production from March, of 112,955 bbl., but an increase of 3680 bbl. in daily average. The total shipments in April were 5,591,339 bbl., a decrease from March of 439,567. The stocks on hand at the end of April amounted to 43,899,497 bbl., an increase over March stocks of 893,888. The field consumption in April was 421,842 bbl., a decrease of 21,247 from the March consumption.

APRIL PRODUCTION BY FIELDS

District	Bbl.
Fresno County	
Coalinga	1,544,897
Kern County	
Midway	1,934,387
Kern River	930,482
McKittrick	461,267
Sunset-Maricopa	449,846
Lost Hills	105,241
Total Kern County	3,881,223
Santa Barbara County	
Santa Maria, Lompoc, Cat Canon	439,332
Summerland	4,350
Total Santa Barbara County	443,682
Southern Counties and Fields	
Fullerton	484,574
Salt Lake	224,537
Coyote	89,926
Whittier	56,689
Ventura County	43,593
Los Angeles	31,842
Newhall	9,990
Total Southern Counties and Fields	941,151
Total all Fields	6,810,953

APRIL OIL STOCKS

District	Bbl.
Kern River	27,079,357
Coalinga	2,895,860
Midway	1,812,896
McKittrick	816,101
Sunset Maricopa	769,627
Santa Maria	637,713
Los Angeles	463,128
Fullerton	298,383
Lost Hills	236,502
Salt Lake	163,974
Ventura	92,423
Whittier, Coyote, Newhall	62,790
Miscellaneous pipe lines	8,570,743
Total in all fields and pipe lines	43,899,497

The field-development record shows 39 new rigs, 61 completed wells, 5553 producing wells active, 761 producing wells idle, 416 drilling wells active, 364 drilling wells idle, no wells abandoned.

Yerington District, Nevada

SPECIAL CORRESPONDENCE

The Yerington mining district is in a more prosperous condition than at any time in its history. During the last few weeks, to the list of shippers have been added the Malachite Copper Co. and the Yerington Copper Co., as well as a number of independent shippers from properties along the line of the Nevada Copper Belt Railroad.

FAVORABLE SMELTING RATES

The smelter situation at Wabuska is unusual in that ores can be shipped to it from points within approximately 90 miles at a cost on medium-grade ores not to exceed $1 per ton, and small shippers receive about the same smelting rate as the large shippers who contract for delivery of a certain tonnage weekly. A number of small owners are taking advantage of this condition and are making shipments to the smelting works of ore that they can sort out of their dumps or gopher out of surface workings. It has furnished an incentive to both development and prospect work in the country from Reno as far south as Laws, California.

There is talk of the Mason Valley Mines Co. increasing the length of its furnaces, so as to handle an increased tonnage, and only run one furnace at a time, holding the other in reserve. A good stock of ore is being bedded at the works, resulting in less lime and coke being required for fluxing.

SHIPMENTS FROM PORPHYRY OUTCROP

The properties situated on the porphyry outcrop near the river, just south of the town of Yerington, are shipping regularly from one to three cars of ore per week. Under this porphyry area there is considerable copper stain, but no gossan, strictly speaking. It is in the more intensely stained areas that the ore is being mined and it is possible that a number of these openings will extend in depth to more or less permanent orebodies. The porphyry area outcropping above the surface wash, is about ¾ by ½ mile in extent.

It has never been successfully worked heretofore, owing to the small furnaces erected and the fact that the ore did not

contain sufficient fluxing qualities. When these small furnaces were run, the iron was shipped for long distances and the coke hauled over 14 miles of rough road, consequently the overhead charges were large. One can now ship a 4% ore to the smelter at Wabuska at a slight profit, the profit increasing very materially with a rise in copper contents to 5 and 6%. It is ores of this grade that are now being shipped at a handsome profit to the leasers who are scattered over the property of the Empire Nevada Copper Co. To date, nothing startling has developed in the way of orebodies, outside of the deeply stained porphyry. The copper is in the shape of a superficial coating of malachite, and in places a thorough impregnation of malachite and cuprite is seen throughout the porphyry.

The Yerington Copper Co. is shipping from a quartz vein impregnated with copper, on the contact of a metamorphic limestone and lamprophyre. This contact vein is persistent both vertically and on the strike, and is small and, except in the larger portions, highly siliceous. The vein has an average width of approximately two feet. All of this is not shipping grade. Recentiy a car of sorted ore averaged 15%, as sampled at the smeltery.

The Malachite property is shipping approximately one car per day of good ore. This property adjoins the Mason Valley Mines Co.'s property on the south. The ore is taken from what appears to be the same orebody that the Mason Valley mine is working. The ore is a highly oxidized garnetiferous lime, impregnated with sulphide and carbonates, and makes an ideal smelting mixture.

Adjoining the Malachite, the McConnell property continues shipments of one to two cars daily, of good ore. This ore is similar in every respect to the Malachite Co.'s ore, and is most acceptable at the smeltery. The properties above mentioned are working from 5 to 20 men, and from general appearances will increase their working forces at an early date.

Nevada-Douglas Ships 2600 Tons Weekly

The Nevada-Douglas Copper Co. continues shipments at the rate of approximately 2600 tons per week, the ore averaging over 5%. The tonnage is about equally divided between the Douglas Hill ore and the Ludwig ore. This tonnage will be maintained at and above this figure for an indefinite period. The smelter will accept all the ore delivered, although the contract is for but 10,000 tons per month.

The Douglas Hill workings are being extended in every direction with excellent results and new ore is being opened up almost daily. The surface cuts are showing up exceptionally well, the ore continuing better than 5% in copper. It is mined cheaply. At what is called the Old Meat House Cut, a face of ore about 60 ft. wide has been uncovered on the surface and has every indication of extending into the hill for some distance. Extensive work is planned for future development, among which is a new double-track tunnel from alongside the tram line at a point 125 to 150 ft. below the present workings of Douglas Hill, also a 3-ton ore bin about 40 ft. down the hill from the present upper terminal ore bin, so that sorting of ore will be facilitated and the working of the tramway greatly improved.

The Casting Copper shaft is being sunk, a point 125 ft. from the surface having been reached recently. The shaft is two compartment and is all in garnet lime. This shaft is to be sunk to the 225-ft. level before any further crosscuts or drifts are made. The bottom of the shaft is in ore and the 100-ft. level station shows a good width of shipping ore.

At the Ludwig, chalcocite has been struck in the 619 winze at the extreme south end of the sixth level. The 700 south drift, for one week recently, averaged about 4% in copper. No secondary enrichment was evident on close examination, and the company is highly encouraged at this tenor of ore coming from the primary portion of the vein. The five raises, all under way, are being pushed rapidly, most of which are producing a daily tonnage of good ore. At present no rock assaying less than 2.8% copper is considered ore, and all below this grade is being thrown on dumps.

Gypsum Shipments Increasing

Gypsum shipments are being increased weekly. The quarry is being put in shape for economical extraction of the rock gypsum. A derrick will be installed soon, at which time the quarry floor will be dropped vertically about 20 ft. This will give a face of approximately 70 ft. to work on.

The Yerington district at present is employing at smelting works and mines, approximately 500 men. The district is badly handicapped at present by the influx of 10-day men. The mines are good places to work in, being dry and well ventilated; and no complaint is heard from the men, as far as the general treatment is concerned. Good, steady men with families, or industrious single men wishing steady work, could not do better than to come to the Yerington district, and in time the camp would be made up of men who hold their positions from one year's end to the other, instead of as now, when, with a force of 60 men, a company is compelled to carry on its rolls approximately 100 men during the month. Within five miles of any of the mines, there are ranches, and green foodstuffs are to be had in plenty in season.

Lackawanna Steel Company

This company owns iron and coal mines and extensive steel works, the mills being at Buffalo, N. Y. The report for the year ended Dec. 31, 1911, shows $24,750,000 capital stock outstanding; $25,000,000 bonds; $10,000,000 debentures and $7,058,000 bonds of subsidiary companies.

The company received during 1911, from mines which it owns, or is interested in, and from other sources, 987,314 gross tons of iron ore, and produced a total of 844,829 tons of coke and 735,980 tons of pig iron. It also produced 345,038 tons of bessemer ingots and 453,214 tons of openhearth ingots, a total of 798,252 tons of steel. Shipments of products were: Rails, 244,220 tons; shapes and angles, 152,005; plates, 52,756; merchant steel, 77,010; sheet iron, billets and blooms, 92,967; pig iron and miscellaneous, 141,405; total, 760,363 long tons, being a decrease of 322,152 tons from 1911. Since Jan. 1 the orders have increased largely.

The income statement for the year is as follows:

Gross sales and earnings....	$21,040,337
Manufacturing and operating costs	17,394,307
Net earnings from operation	$3,646,080
Interest and dividends received	584,913
Total income	$4,230,993
General expenses and taxes..	739,515
Net earnings	$3,491,478
Interest, rentals and sinking funds	$2,466,492
Depreciation	942,183
Total charges	$3,408,675
Surplus for the year.....	$82,803

The report says: "The demand for the company's products continued small during the first half of 1911, and though somewhat increased during the latter part of the year, was, as a total, unsatisfactory, as evidenced by the shipments for the year. During the month of May, 1911, there was a serious break in prices, so that the business done during the last half of the year was at the lowest figures, conditions considered, that have ever obtained in this country.

"The properties have, during the last year, been maintained in high physical condition. The new merchant bar mill, mentioned in the report of a year ago, was completed and put in operation during September, 1911, and contributes much to the greater diversification of the company's products. In order to meet the increasing demand for openhearth steel, the company's producing capacity will be increased during 1912 about 35%, by the construction of two 60-ton furnaces and a hot-metal mixer for the openhearth department. Further additions to the openhearth ingot capacity will have to be made in the near future."

A Discussion of Radio-Chemistry

By Harry C. Jones *

The discovery of the X rays excited interest in naturally fluorescent substances, which led to the discovery of the radioactive elements. The study of these leads to a totally new chemical idea: the idea of an unstable chemical atom, and the production of one element from another.

*Professor of Physical Chemistry, Johns Hopkins University, Baltimore, Md.

A new branch of physical chemistry has come into existence during the last two decades. The phenomena brought to light in this field are so different in kind from anything known before, that we might almost say that we had here a new branch of natural science. The phenomena in question are known as radioactive, and the branch of science as radiochemistry.

We shall have to deal here with transformations, as we shall see, which differ from any chemical changes hitherto known or even suspected. We shall have to do with unstable chemical elements, and with one chemical element passing over into another, or at least yielding another chemical element as one of its decomposition products; in a word, with the birth of a chemical element—something hitherto undreamed of.

We shall also have to do with the production of heat energy in quantities several million times as great as that of the most exothermic chemical reaction; in quantities so great that when first discovered it raised the question in the minds of some, whether the law of the conservation of energy had not been overthrown, whether we did not have here a system which actually created heat energy.

Conservation of Energy Holds with Radium

To allay any fear in this direction, let it be said in advance that such is not the case; and that the law of the conservation of energy holds just as well today as it did before radioactive phenomena began to be studied.

It will be seen from this preliminary sketch that in radiochemistry we are to deal with phenomena that do not differ simply in degree from those already known but literally in kind.

It is obvious that these papers would be intolerably incomplete and unsatisfactory, were we not to discuss the more important of these phenomena.

We shall, therefore, trace briefly the discovery of the radioactive elements, the investigation of their properties both from the chemical and the physical standpoints, and finally attempt to explain or account for radioactive phenomena.

Discovery of Radioactivity

A paper was published in 1895 by Röntgen "On a New Kind of Radiation." When this paper first appeared it almost immediately attracted worldwide attention. When an electric discharge is allowed to pass through a high vacuum tube there is given off a kind of radiation which has different properties from any other radiation known to man. This radiation, as is well known, has great penetrating power, passing readily through objects opaque to light, and even through films of the metals of considerable thickness.

The important point in this connection is the source of this radiation. Where does it come from? It was first supposed to come from the anode on which the cathode rays impinged, but was later shown to come from the spot on which the cathode rays impinged on solid matter. If the cathode rays were made to fall on the the wall of the discharge tube, the spot on which they impinged became the source of the new kind of radiation which was soon called the "X" ray.

The spot on the glass wall on which the cathode rays impinged and from which the "X" rays started, shone with a greenish-yellow fluorescence for most glasses. The exact color of the fluorescence depended upon the nature of the glass, but this is, for the present purpose, not essential. Whatever the nature of the glass the spot upon which the cathode rays impinged shone with fluorescent light, and it was from this spot that the "X" rays came off.

This led the distinguished French physicist, Becquerel, to conclude that there was probably some connection between the fluorescence produced on the glass by the cathode rays, and the "X" rays which originated from this spot. This conclusion, although erroneous, led to an important discovery. The fluorescence had nothing whatever to do with the production of the "X" rays.

X Rays are Simply Pulses

These are simply a set of irregular pulses in the ether, set up where the cathode rays fall upon solid matter. The irregularity of the pulses is the cause of the great penetrating power of the "X" rays. They do not produce resonance since they are irregular vibrations, and, consequently, most substances are transparent to them.

The thought that there is some connection between the fluorescence of the glass and the origin of the "X" ray, led Becquerel to examine naturally fluorescent substances to see whether they gave off any radiation with properties at all similar to those of these rays. Prominent among the naturally fluorescent substances are the ores and salts of uranium. These substances have a strong, greenish-yellow fluorescence and the salts of uranium can readily be prepared of a high degree of purity.

Becquerel soon found that salts of uranium give off a kind of radiation that in some of its properties resembles the "X" rays, and in others resembles light. The uranium radiation has much greater penetrating power than light, and can penetrate layers of substances that are entirely opaque to light. Further, these radiations have some properties that differentiate them sharply from "X" rays. Without going into unnecessary detail here, it can be stated in general that the uranium radiation occupies a position intermediate between light and the "X" ray.

Early Investigations of Radioactivity

Having found that uranium compounds give off a characteristic radiation—are as we say radioactive—Becquerel suggested to Mme. Curie that she examine uranium ores and minerals in the same connection. The result of her investigation was to show that uranium minerals are, in general, radioactive, and some of them far more radioactive than pure uranium itself. The uranium mineral richest in uranium contains only about 60% uranium.

What was Mme. Curie forced to conclude as to the cause of the high radioactivity of certain pitchblendes? The only conclusion seemed to be that these substances must contain some constituent which was more radioactive than pure uranium itself. Since the known constituents of pitchblende analyzed 100% to within the limit of error of experimental methods, this radioactive constituent of the pitchblende must be present only in small quantity; and, therefore, must have great radioactivity.

Mme. Curie then set about to isolate the radioactive constituent from pitchblende. This mineral is one of the most complex substances known to man, and the problem of obtaining from it an infinitesimal quantity of a supposed substance even of a fair degree of purity, seemed at first thought hopeless. There was, however, one property of this substance which saved the day for Mme. Curie, and that was its great radioactivity. In the chemical transformations

to which pitchblende was subjected, the radioactive constituent could always be detected by means of its radioactivity.

Mme. Curie, by a series of difficult separations, finally succeeded in obtaining from pitchblende a new element, which was about one and a half million times as radioactive as metallic uranium, and this was the element radium.

Radiations Given Out by Radium

The most obvious property of radium and other radioactive substances is to emit radiations. Indeed, this is what we mean by a substance being radioactive. The radiations given out by radium are of different kinds. Some of these radiations have small power to penetrate matter, and are deflected in a magnetic field, but with difficulty. These are known as the alpha radiations.

There are other radiations given out by radium, which have considerable power to penetrate matter, and which are readily deflected in a magnetic field. These are known as the beta radiations.

There is still a third kind of radiation given off by radium, which has enormous power to penetrate matter and which cannot be deflected at all in a magnetic field. These are known as the gamma radiations.

We must look a little more closely into the properties of these three kinds of radiations, to see what these different kinds are.

Take first the alpha particles which make up the alpha radiation. The masses of these have been determined by a method which it would lead us too far here to discuss. It was first worked out by Sir J. J. Thomson in connection with his study of the particles in a cathode discharge tube.[1]

The mass of the alpha particle has been shown to be four times that of the hydrogen atom. This is the mass of the helium atom, and, indeed, it has been shown that the alpha particles are helium atoms. The alpha particles are, therefore, pieces of matter, having a mass of four as expressed in our atomic weight units, shot off from radium with a certain velocity, and what is this velocity?

Properties of Alpha Radiations

The same general method which was employed to determine the mass of the alpha particle, also gave its velocity. It was found that the velocity of the alpha particle is about 2.5×10^9 cm. per sec., about one-tenth the velocity of light. The alpha particles or helium atoms shot off from radium are, then, the most rapidly moving pieces of matter known to man. Indeed, there is no other known form of matter which moves with a velocity at all comparable with this.

[1] "The Electrical Nature of Matter and Radioactivity," by H. C. Jones.

The result of this considerable mass and high velocity, is that the alpha particles have large kinetic energy. They, therefore, ionize a gas through which they pass, affect a photographic plate, produce fluorescence when allowed to fall on a fluorescing screen, etc.

This property of exciting fluorescence has been utilized in the well known instrument, the spinthariscope. Some radium salt is diluted by mixing it with some neutral powder, and a screen covered with zinc sulphide or barium platinocyanide is placed above the radium salt. When the alpha particles are given off from the radium they fall upon the fluorescent substance, and where they strike there is a flash of light. If the radium salt is sufficiently diluted we can see the individual splotches of light upon the screen. When the screen is observed by means of a lens the appearance is that of the milky way on a dark night, the individual splotches of light appearing and disappearing in quick succession.

Since the alpha particles are matter and have considerable size, we can easily see why they cannot pass through any considerable thickness of matter.

The Beta Particles are Electrons

The beta particles have much smaller mass than the alpha particles, indeed, only about one-four thousandth the mass, and they move with different velocities ranging all the way from one-tenth nearly up to the velocity of light.

An exhaustive study of the properties of the beta particles shows that they are nothing but cathode particles such as are set free in the cathode discharge tube. These were shown by Thomson to be isolated charges of negative electricity or electrons as they were termed. The alpha particles were pieces of what we ordinarily call matter charged positively. The beta particles are the units of which all matter is made up. It would lead us too far to go into this in any detail, yet it cannot be passed over without a few words.

It was shown by Sir J. J. Thomson about 15 years ago, that a common constituent can be obtained from all elementary forms of matter. This constituent, which is the cathode particle or electron, was shown to be an isolated charge of negative electricity and nothing else. It had mass and inertia, but isolated electrical charges moving with high velocities through an elastic medium such as the ether, were also shown to have mass and inertia; and not only so, but exactly the mass and inertia which the electrons had. There were, therefore, no properties of the electron that could not be accounted for quantitatively as due to the electrical charge, and there is, therefore, no reason for assuming that the electron contains anything except the electrical charge.

Electrical Charges the Ultimate Unit

Since the same electrons are obtained from all known forms of matter, it is reasonable to conclude that all of the elements are made up of electrons of the same kind. In a word, the ultimate unit of all matter, the unit of which all matter is made up, is not matter at all, but the unit electrical charge.

This raises the question why did we ever suppose that there was any such thing as matter? The answer is, matter was a creation purely and simply of the imagination, for the purpose of having something to contain the electrical energy. We could not at that time think of energy in the abstract; we had to have something to attach it to, and consequently, we imagined the existence of another entity than energy and called it matter. This idea will probably impress one at first repulsively, on account of our preconceived idea of matter, having used this term so long.

Energy the Only Entity

A moments' thought will serve to offset this prejudice. Have we any method of measuring so-called matter? Have we even a method of detecting matter qualitatively? Certainly not. We can detect and measure mass and inertia, but we have just seen that these are properties of the isolated electrical charges. There are, therefore, no properties that are not accounted for by the electron—as isolated electrical charges. Having no properties to account for, why should we assume the existence of any other entity than energy? If we persist in assuming the existence of any other entity than energy, then we must admit that it has no known properties; and since we know things here below only by their properties, we are placed in the embarrassing position of knowing the existence of an entity matter, through its properties, of course, when it has no property known to man.

There is not the slightest reason to-day for assuming the existence of any other entity than energy—the old imagined matter being now only historically interesting.

The beta particles are isolated negative charges of electricity, differing from ordinary cathode particles only in this that they move with higher velocities. This fact alone enables us to understand the properties of the beta particles, including their great power to penetrate matter.

There is a third kind of radiation given off by radium—the gamma radiation. These cannot be deflected in a magnetic field and can penetrate a foot of solid steel. A study of the properties of the gamma rays in general shows that they are very penetrating "X" rays. They oc-

cur only when the beta rays occur, and are produced by them. Where the beta rays impinge upon matter gamma rays arise, just as where the cathode particles impinge upon matter "X" rays are sent off.

Radium Radiations

It was found in the early study of radium that its salts can give off light; are, as we say, self-luminous. A fairly pure radium preparation can be readily seen in a dark room. Radium has, further, the property of charging itself electrically, under certain conditions. Radium salts shoot off both positively and negatively charged parts. The alpha particles, or helium atoms, are charged positively. The beta particles, or electrons, are charged negatively. If the radium is placed within an insulating box which will absorb the alpha particles, and the beta particles allowed to pass through the insulation and fall upon an outer metal box, they will give up their charges to the metal which will conduct it off to earth, and the radium will become charged positively.

Another physical action of the radium radiations is their power of rendering nonconductors of electricity conductors. Pure liquids, in general, are non-conductors of electricity, are, as we say, insulators. If many of these are subjected to the action of the radium emanation they show appreciable conductivity. This means that these pure liquids are ionized to some extent by the action of the radiations from radium. The question arises which radiations are the most effective in ionizing, say pure liquids? The alpha particles have several thousand times the mass of the beta particles, and although they move only about one-fifth as fast, the kinetic energy of the alpha particles is many times as great as that of the beta particles. We would, therefore, expect the ionization on the surface of liquid dielectrics to be due to the alpha particles. It must, however, be remembered that the alpha particles have little power to penetrate matter; and, therefore, any ionization in the interior of such substances would have to be due to the radiations that have greater power to penetrate matter, i.e., the beta and especially the gamma radiations.

Insulators Rendered Conducting by Radium

The radiations from radium not only ionize liquid dielectrics but also solid. Even the best solid insulators show appreciable conductivity under the influence of the radium radiations. This must be due to a partial ionization of these substances under the influence of the radiations given off by radium.

The action of radium salts upon living tissue is well known. Becquerel, who carried some fairly pure radium bromide in a glass tube in his vest pocket, suffered a severe burn. This action of radium radiations upon living tissue has been used as a curative agent. In certain skin diseases where the cause of the disease is located just beneath the surface of the skin, the exposure of the diseased part to the radiations from fairly pure radium will often serve to destroy the cause of the disease. That radium is a curative agent in such cases there can be no reasonable doubt.

That too much has been claimed for radium in this direction is also certain. That it may have some effect upon so-called skin cancer is probable, but that it has much influence upon this disease after it has progressed well into the deeper tissue is doubtful.

The radiations from radium have the property of effecting some remarkable chemical changes. If a fairly pure specimen of radium bromide is kept in a glass tube for any considerable time, the tube, if of sodium glass, becomes deep brown in color, if of potassium glass it acquires a deep purple hue. I have seen glass tubes in Sir William Ramsay's laboratory, in which radium bromide had been sealed up for some time, so deeply colored as to be only semi-transparent. This was due to the decomposition of the stable silicate, glass, by the radiations, liberating, on the one hand, sodium, and, on the other, potassium. This is, obviously, a remarkable chemical reaction.

Even more remarkable, perhaps, is the production of ozone from oxygen under the influence of the radium emanation. What does this really mean? Ozone differs from oxygen in containing more intrinsic energy in its molecule. This is shown by the fact that when carbon is burned in ozone more heat is liberated than when burned in oxygen. The additional intrinsic energy in the ozone comes from what? In this case from the energy of the radium radiations which are allowed to impinge upon the oxygen, and which transform it in part into ozone.

Production of Heat by Radium Salts

One of the most remarkable of the many remarkable properties of radium salts, is the production of heat, and of enormous quantities of heat. This fact was first observed by the Curies and Laborde in 1903. It was noticed that a small pile of radium bromide maintains itself about 1½° C. above the temperature of the surrounding medium. This is, of course, a most remarkable fact, and led quickly to the measurement of the amount of heat liberated by salts of radium.

Two methods were employed in making such measurements. One was to allow a weighed quantity of the radium salt to volatilize liquid hydrogen, and then determine how much liquid was converted into gas in a given time. Knowing the heat of vaporization of hydrogen, it was a perfectly simple matter to calculate the amount of heat liberated by the radium. This method might be characterized as a pyrotechnic one. The method which gave really reliable results was the one based upon the ice calorimeter. This method is based upon the melting of ice by a given quantity of the radium salt, and then determining the amount of water formed in a given time. Knowing the heat of fusion of ice, we have all the data for calculating the heat liberated by radium.

Radium Melts its Own Weight of Ice Hourly

The result is most surprising. Radium liberates enough heat to melt its own weight of ice every hour. Since 80 cal. of heat are required to melt 1 gram of ice—a calorie being the amount of heat required to raise 1 gram of water 1° C.—it follows that a gram of radium gives out every hour during its entire life of about 2500 years, about 80 cal. of heat.

This is enormous. Indeed, it has been shown that the amount of heat liberated by radium is between three and four million times that of the most exothermic chemical reaction, viz.: the reaction between hydrogen and oxygen.

The question is, what is the source of this heat? Some at first supposed that the law of the conservation of energy did not hold here, and we had a creation of energy. Others suggested that radium converts some unknown form of energy into heat. This was unscientific. If we must imagine some unknown form of energy in order that radium can convert it into heat, we had as well imagine the heat produced from something that is not energy. The explanation now offered of the source of the heat in radium is that it is produced by the alpha particles striking against some of the solid radium salt. They are stopped, and their large kinetic energy is converted into heat. This, of course, explains nothing. It leaves unanswered the question how did the alpha particles get their high velocities?

To answer this we must consider what the alpha particles are. They are complex masses of electrons moving with enormous velocities within the radium atom. But this is what we call intrinsic energy. The heat then comes from the intrinsic energy of the radium atom, which is enormously great and this, as we shall see, probably accounts for the instability of the radium atom. The bearing of the large amount of heat liberated by radium upon the calculated age of the earth is interesting and important; but for this, see my "Electrical Nature of Matter and Radioactivity," 2nd edition, pp. 112-117. (D. Van Nostrand Co., N. Y.).

The Radium Emanation

Rutherford noted that when an electroscope is exposed to the action of the radiations from a radioactive substance, and a current of air is blown between the substance and the electroscope, the electroscope is discharged at an inconstant rate. When there are no air-currents the radioactivity is constant. It seemed probable that the constituent removed by the air current was something with the general properties of a gas. This observation was first made with salts of thorium.

Rutherford drove off this gaseous substance from radium, on the one hand by fusing the salt, on the other, by dissolving the salt in water, and bubbling an inert gas, like hydrogen, through the aqueous solution. When the escaping gases were passed through a U tube surrounded by liquid air, the radioactive gas condensed. The liquid formed from the radioactive gas was so small in quantity that it could not be seen in the glass tube. All that could be seen was a fluorescent spot on the glass tube where the gas had condensed. On warming the tube containing the substance it was found that it boiled off at about —150° C. This substance, having the properties of a gas, Rutherford called the "emanation."

The amount of the emanation present in radium salts is almost infinitesimal. A gram of radium yielded only three-fifth's of a cubic millimeter of the emanation in the form of a gas. This shows why the condensed gas could not be seen in the glass U tube.

Emanation Produced by Radium

If some radium salt is fused and all the emanation pumped out and the salt then set aside for a time, another crop of the emanation can be obtained; and this process can be continued almost indefinitely. This shows that the emanation is produced by radium, and that the process is a continuous one. A physical study of the emanation has been made; a comprehensive chemical study has thus far been impossible, on account of the difficulty, indeed, impossibility of obtaining the emanation in sufficient quantity. It seems to be, like radium, an elementary substance, and thus we have one element produced from another element. This is the first example of the production of a chemical element from another element, or from anything else known to man.

The study of the radium emanation has led to some remarkable results, results so remarkable that they differ in kind from anything hitherto known. We were astounded at the amount of heat given off by radium, but we will be far more astonished to learn that about three-fourths of all of the heat given off by radium comes from the radium emanation. When we reflect what an infinitesimal trace of gas the emanation is, and then think of the amount of heat that it sets free, we realize that we are dealing with phenomena fundamentally different from anything hitherto encountered by the man of science.

Induced Radioactivity

When the radium emanation settles down upon almost any object it renders that object radioactive for the time being. It does not make much matter what the nature of the object is that is brought in contact with the emanation, that object becomes at once radioactive. This phenomenon has been studied carefully, and there can be no doubt of the correctness of this conclusion.

The induced radioactivity, however, lasts for only a short time. It decays as we say and yields a number of products, some of which will be referred to a little later.

Emanation Produces Helium

The radium emanation, as we have seen, lasts for only a short time. It disappears as such, and the question arises what is produced in its stead? It should be stated that the emanation decays at a rate that is entirely independent of temperature or any other condition that can be imposed upon it. The emanation is also formed by radium at a rate which is the same at the temperature of liquid air and at very elevated temperatures. These transformations are, therefore, something different in kind from ordinary chemical reactions; all chemical reactions having a temperature effect, or, as we say, a temperature coefficient.

Sir William Ramsay, in 1903, showed that when the radium emanation decays it yields among other things the element helium. Ramsay, only a few years before, had shown that the element helium, which up to that time had been found only in the atmosphere of the sun, occurs also in the atmosphere of our earth in small quantities. He sealed up some of the radium emanation in a glass tube, into the ends of which he fused platinum wires. After allowing the emanation to stand in the tube for some time, he passed an electric spark between the platinum wires and observed the emitted light through a spectroscope. He showed that the gas which contained no helium at first, now contained helium.

Radium Decomposition not a Transmutation of the Elements

This result has been verified over and over, so that there is now no reasonable doubt that helium is produced from the radium emanation, as one of its decomposition products. Here is an unmistakable example of the production of one chemical element from another.

When this discovery was made there followed not a little sensational literature, to the effect that here was an example of the "transmutation of the elements." One element, the radium emanation, had been transformed into another element, helium; and we read such statements as "the dream of the alchemists had been realized."

A moment's thought will show that this is without the slightest foundation. What the alchemists sought to do was to find some artificial condition, which they could control, for transforming a given chemical element into another element and indeed into gold.

Here we have the radium emanation,—an unstable system, passing over spontaneously into several things, one of these being the element helium; and this transformation not only takes place spontaneously, but it cannot be influenced in the least by any external condition that can be brought to bear on it. We cannot even increase or decrease the rate at which the transformation goes on, by wide ranges in temperature.

We are apparently just as far to-day from effecting a transmutation of the elements, in the sense in which that term has been used, as they were in the days of the alchemists.

The radium emanation, when it breaks down, yields, in addition to helium, radium A, B, C, D, E and F, but it would lead us too far to discuss these substances here.

What Radioactive Phenomena Really Mean

We have seen that radium is continually producing the emanation. When this is removed by fusing a radium salt, or by bubbling a neutral gas through an aqueous solution of a radium salt, more of the emanation is formed. When the second crop is removed a third is formed and so on as long as the radium lasts. Radium is thus producing from itself a radioactive form of matter. A similar fact was discovered in connection with uranium and with thorium.

Sir William Crookes discovered the following: When ammonium carbonate is added to a solution of a uranium salt, the uranium is at first precipitated. The addition of more of the carbonate dissolves the precipitate, but there remains a small residue which does not dissolve. This is the radioactive constituent of uranium. When this uranium X, as it is termed, is separated from uranium, more uranium X is formed, and this goes on apparently indefinitely.

Similarly, a radioactive constituent was separated from thorium known as thorium X, and this is produced continuously by the thorium.

With these facts and those discussed earlier in mind, we can now approach the

problem of the meaning of radioactive phenomena. Since uranium, thorium and radium are producing radioactive forms of matter from themselves, it follows that the atoms of these substances are undergoing change—are, as we say, unstable. They are breaking down, yielding other things.

The question that arises is how can a chemical atom be unstable? How can an indivisible, ultimate unit be unstable? It is difficult to conceive of an unstable atom in terms of the older, chemical definition of an atom, but here the recent work of Sir J. J. Thomson comes to our aid.

The Atom Highly Complex

Thomson has shown that the simplest chemical atoms are complex, and the atoms with large atomic masses such as uranium, thorium and radium are very complex indeed.

He has obtained the electron or unit negative charge of electricity from many kinds of atoms, and has made it highly probable that the atoms of all substances are made up of unit negative charges of electricity moving in a field of so called uniform, positive electrification. These units, negative charges of electricity, or the negative electrons, are moving with high velocities, and in definite orbits within the atoms, the intrinsic energy of an atom being chiefly the kinetic energy of the moving electrons within the atom.

The atom of one substance differs from the atom of another in the number, arrangement, and possibly the velocities of the electrons that compose it. For further details, see my "Electrical Nature of Matter and Radioactivity," pp. 1 to 40 (D. Van Nostrand Co., New York).

This work of Thomson, which was done just before the phenomena of radioactivity were discovered, furnishes the explanation of these phenomena. In the light of this work we can easily see how an atom can be unstable. The electrons, moving with enormous velocities, may come into positions such that they will be carried entirely out of the atom and fly off into space. Such is the case with the beta particles given off by radium.

We may also think of large groups of electrons coming into such positions relative to the remainder of the atom that they will fly off into space. Such are the alpha particles shot off by radium. We would expect such an unstable atom to be more unstable during the early part of its life history, and more likely to give off groups of electrons than later on and such again is the fact. The alpha particles tend to come off first, and the beta particles later on. The possibility of unstable atoms having been established by the work of Thomson, we can easily account for radioactive transformations—one form passing into the succeeding form with loss of one or more constituents.

Thus, radium loses an alpha particle and passes into the emanation. The emanation loses an alpha particle and yields radium A. Radium A loses an alpha particle and yields radium B. Radium B gives off little or no radiation and passes into radium C, which gives off alpha, beta and gamma rays and yields radium D. Radium D passes into radium E without loss of radiations, while E passes into F with loss of alpha particles. Radium F then probably passes into lead, which may be regarded as the ashes of radium.

The life history of radium is between 2000 and 3000 years. Therefore, none of the radium now in existence was in existence 3000 years ago. The question arises where did the radium now in existence come from?

Whence Came Our Radium?

It was shown that radium occurs in uranium minerals, and that the amount of radium present is proportional to the amount of uranium in these minerals. This seemed to make it probable that radium was formed from uranium, that uranium was the parent of radium.

Uranium salts were carefully freed from radium, and set aside for a time to see whether any more radium was formed in them. It was found that no more radium was produced in the uranium salt, during the time over which observations extended.

This led to the suspicion that there was some intermediate product formed between the uranium and the radium. Such has recently been found and is called ionium; the sequence being—uranium $\longrightarrow$ uranium X $\longrightarrow$ ionium $\longrightarrow$ radium.

We have spoken of the amount of radium occurring in pitchblende as being very small, and, further; that pitchblende is the richest radium ore known to man. The question that arises is this. Is the total amount of radium existing in or on the earth infinitesimal, or an appreciable quantity? It is obvious that we are dealing here with two independent questions. The amount of radium in any one locality is small, but what about the total amount in or on the earth?

It has been recently shown that the total amount of radium is considerable, due to its wide distribution over the surface of the earth. In the deposits on the floors of the seas it is estimated that there are a million tons of radium, while in the waters of the seas it is estimated that there are about 20,000 tons of radium. Thus, the total quantity of radium is large, while the amount in any one place is very small.

The scope of these papers will, however, not permit of any further discussion of these or correlated matters There are many things which I should like to have discussed, but which space prohibits. Enough has, however, been incorporated to give some idea of the nature of the recent advances and what they mean both for science and the industries.

Migration of Miners and Accidents on the Rand

By A. W. Rogers*

A short time ago a paper was read before the Chemical, Metallurgical and Mining Society, in Johannesburg, by J. Chilton, on the subject of accidents in mines of the Witwatersrand.

High Percentage of Migration

In the discussions which followed the reading of the paper, it was contended by some that the constant migration of the white employees on the Rand from one mine to another, has the closest relation to the number of accidents which occur. The attention of the government mining engineer, R. N. Kotze, was directed to this suggestion, and he called for returns of changes of personnel occurring in a number of mines for the six months ended June 30, 1911, and of the accidents during the same period. From these returns a table was compiled, which shows that the migration of white employees on the Rand is of astonishing frequency. The highest rate for an individual mine during the six months was 31% of the total white employees per month, and the lowest 4%. The average number of men employed on all the mines from which statistics were obtained was 19,582, and the total number of changes which took place was 16,043, or 82%; that is, nearly 14% per month.

It is contended, and seems highly probable, that the fact that an average of one-seventh of the miners employed have been at their mine one month or less, and two-sevenths not more than two months, must have a great influence on the accident rate, both among whites and natives. A large proportion of the accidents underground is due to falls of the hanging wall, and it is obvious that a miner well acquainted with his mine must be better able to recognize and avoid danger than one who is new to it. A miner in charge of a number of natives (it may be 30 or more), in avoiding danger, not only avoids it for himself, but also for those in his care, and thus it is that accidents among white employees, due to lack of knowledge of the mines on which they are employed, are accompanied by corresponding accidents among natives.

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Doctor Macaulay presented a table at a later meeting of the Chemical, Metallurgical and Mining Society, showing for the half years ended June 30 and Dec. 31, 1911, the percentage of the total death rate from accidents, among white and colored employees, on the chief producing mines of the Rand, grouped according to the percentage of changes in personnel in the white labor force. The figures are given in the accompanying table.

COMPARISON OF RAND MIGRATION AND ACCIDENT STATISTICS.

Changes per Month, Per Cent.	Death Rate from Accident: Jan. to June, 1911, per 1000	July to December, 1911, per 1000	Average for year, per 1000
4 to 5	3.47	0.93	2.2
6 to 10	2.85	2.88	2.87
11 to 15	4.10	4.17	4.13
16 to 20	4.34	3.80	4.07
21 to 25	4.96	5.00	4.98
26 and over	5.10	5.08	5.09

Accident Rate Increases with Migration

The figures for the year, with one exception, show that the higher the migration rate, the higher the death rate from accidents. The majority of the natives employed in the mines are engaged for terms of six months, it being impossible to get sufficient numbers to recruit for longer periods. These natives are, in a large proportion, quite new to mining work and totally uneducated. It will be clear to every mining man, therefore, how vitally necessary adequate supervision must be, and how the constant changes in the white labor force, which would be serious enough on a mine manned by white labor only, must militate against efficiency and safety.

The attention drawn to the subject by Mr. Chilton's paper and the discussions which followed it, resulted in a table being compiled, comparing the death rates by accident in the chief mining countries of the world, the data being obtained from the annual report[1] of R. A. S. Redmayne, chief inspector of mines of England.

World's Mining-Accident Rates Compared

The Rand apparently compares very unfavorably with most other countries, but any generalization from the bare figures would be liable to lead one astray. The statistics, in order to present a fair and true comparison would all have to be compiled on the same basis, and this has not been done. As a matter of fact, the bases adopted by the various countries differ widely, and this was pointed out by S. Evans, in a trenchant criticism of these figures. Mr. Evans contends that in no other country in the world are accident statistics subjected to such constant and close government inspection as on the Rand. In many countries, he states, accident statistics are only made out once a year and the mines are rarely, if ever, visited by government inspectors.

Then, in the Transvaal, it is the custom to include in the total of fatal accidents, any accident that directly or indirectly causes death, whether at the time of the accident, or at any later period. In no country does legislation define what is meant by a fatal mining accident. In the United Kingdom the inspectors class as fatal any accident which directly causes the death of the victim within 12 months after the occurrence of the accident. In Belgium, an accident is not considered fatal if it does not cause death within 30 days of the accident, while in France, where there is no definition, only those accidents which cause death within a very short interval are classed as fatal. In various other countries, too, for an accident to be termed fatal, immediate death must be caused.

Mr. Evans states that there are probably no accident statistics for mines which are compiled in such a way that they can fairly be compared with those of the Transvaal. Leaving apart, therefore, the special circumstances which obtain on the Rand, in regard to the constant changes of personnel, and the employment of untrained natives who outnumber the whites by about eight to one, he contends that Rand figures do not really compare so badly with those of other countries. It may here be remarked that the United States figures are high, but this is largely accounted for by the fact that the rates given relate to the principal coal-producing states only.

FATAL ACCIDENT RATE PER 1000 EMPLOYED IN MINES THROUGHOUT THE WORLD.

Country or District	1908: Coal	1908: All Mines	1909: Coal	1909: All Mines
Alberta	..	..	..	1.73
Algeria	..	0.85	..	1.64
Australia	..	1.42	..	1.16
Austria	1.10	1.01	1.13	1.10
Belgium	1.07	1.06	0.95	0.95
Bohemia	..	1.36	1.20	1.15
Bosnia	2.67	1.78	2.77	2.30
British Bornea	..	..	11.88	11.88
British Columbia	2.96	3.99	8.88	7.62
British Guiana	..	0.69	..	0.85
Bulgaria	0.92	0.92	..	....
Cape Colony	..	2.35	1.23	1.25
Ceylon	..	0.24	..	0.11
Egypt	..	..	..	3.08
France	0.95	1.08	1.17	1.38
Gold Coast	..	2.66	..	3.71
Greece	..	0.88	..	1.55
Hungary	..	1.73	..	2.47
India	1.38	1.50	1.07	1.42
Italy	..	1.29	..	1.31
Japan	1.93	1.55	3.51	2.85
Kimberley	..	2.19	..	1.63
Malay States	..	0.74	..	0.90
Mexico	..	4.64	..	5.78
Natal	11.13	10.38	3.08	2.85
Netherlands	2.36	2.36	1.03	1.03
New S. Wales	1.16	1.36	0.75	0.93
New Zealand	1.28	1.45	1.67	1.64
Nova Scotia	3.40	3.12	2.98	2.70
Ontario	..	2.77	..	2.87
Orange River	..	1.56	..	1.12
Portugal	..	1.26	..	1.35
Portuguese E. Africa	..	2.02	..	1.03
Prussia	2.62	2.42	2.02	1.88
Queensland	1.79	2.02	1.17	1.99
Rhodesia	..	4.28	..	4.92
Russia	4.27	2.52	..	....
Saxony	1.19	1.30	1.88	1.81
Servia	..	1.01	..	2.73
South Australia	..	0.28	..	0.14
Spain	..	2.28	..	2.31
Sweden	0.48	1.11	..	....
Switzerland	12.20	3.19	..	2.17
Tasmania	..	0.93	..	0.99
Transvaal	3.71	4.03	4.44	5.32
United States of America	3.42	..	3.35	..
Victoria	1.86	0.93	..	0.77
West Australia	3.57	2.32	..	1.85

[1] "Mines and Quarries, General Report and Statistics for 1909." Part IV. "Colonial and Foreign Statistics."

Iron Ore in Mississippi

Director Lowe, of the Mississippi Geological Survey, has prepared a report on the iron-ore deposits in Marshall and Benton Counties in the northern part of that state. Attention was first directed about three years ago to these deposits in the vicinity of Potts Camp, on the Frisco R.R., in Marshall County. Doctor Lowe had made a surface examination of three areas, designated as Potts Camp, Winborn and Hickory Flat. In the first named, three ledges of carbonate ores were found, 8, 14 and 20 in. in thickness. In all three areas another stratum of ore was found, 6 to 8 ft. thick and 20 to 30 ft. below the surface. Doctor Lowe estimated the ore in sight, available at a cost not to exceed $1 a ton on board cars, at 500,000 tons. Other estimates run up to 1,500,000 tons.

Analyses made by W. L. Pardue, of the Mississippi State University, show the following average content for the oxide ores: Metallic iron, 49.53 per cent.; manganese, 8.69; sulphur, 1.38; phosphorus, 0.057; silica, 18.88. The carbonate ores averaged 62.15 metallic iron, 5.77 manganese, 0.87 sulphur, 0.122 phosphorus and 13.345 silica. Calcining increased the percentage of metallic iron. Doctor Lowe's report was optimistic as to the commercial importance of the iron-ore deposits of Mississippi, based on the results of the limited explorations thus far made. One company, incorporated in New Jersey, owns 15,000 to 20,000 acres, and another has had representatives in the field for several months.

U. S. Phosphate Production

The production of phosphate rock in the United States continues to increase steadily, according to Frank B. Van Horn, of the U. S. Geological Survey. The production in 1911 is given at 3,053,279 tons; for 1910, 2,654,988 tons; for 1909, 2,338,264 tons. Florida still continued to lead in production, with 2,436,248 tons; Tennessee second, with 437,370; and South Carolina third, with 169,156 tons.

The feature of the year was the prospecting of a new area in central Kentucky. New deposits were also discovered in Montana, and it is now estimated that there are over 2,500,000,000 tons of mineable rock, carrying over 70% of $Ca_3(PO_4)_2$, in the Western fields.

Rapid Methods for Proximate Analyses

The outline of a scheme for the quick, but commercially accurate, determination of silica, iron, alumina, lime, zinc, copper and lead in ores and slags.

Note—Abstract of a paper, entitled "Quick Combination Methods in Smelter Assays," by A. T. French; bull. 89, I. M. M.

The scheme of analysis here presented is for the determination of insoluble, Fe, Al_2O_3, CaO, Zn, Pb, S and Cu, in the presence of the usual constituents of ores and slags. The results reported should be within 0.25% of the truth, except on copper.

First Method for Ores

For the general analysis, weigh out two 0.5-gram samples into casseroles, moisten with water, add 5 to 10 c.c of conc. HNO_3, and take to dryness on a hot plate; add 5 c.c. of HCl to each, and after digesting for a few minutes at a moderate temperature, add 20 c.c. of dilute H_2SO_4 (1:3), and carry the assays rapidly down to white fumes. Cool and dilute to about 100 c.c., to (1) add 5 c.c. of HCl; to (2), 10 c.c. of dilute H_2SO_4, and boil both for a few minutes. In (1) insoluble, SiO_2, Fe, CaO and Zn are to be estimated; in (2) Pb, Cu and Al_2O_3.

(1) *Insoluble*—The hot solution is filtered through an ashless paper and washed thoroughly with hot water, the filtrate is removed and the residue washed with a hot solution of ammonium acetate, the washings are thrown away, and the filter with contents is ignited and weighed as "insoluble."

The filtrate in a 600-c.c. beaker is diluted with hot water to 300-400 c.c., about 10 grams of pure ammonium chloride added, and if manganese is present 10 to 20 c.c. of strong bromine water, then an excess of NH_4OH. The solution is brought to a boil, the precipitate allowed to settle and then filtered, washing with hot water, or better, if much zinc is present, with a hot dilute ammoniacal solution of ammonium chloride. The filtrate and washings are received in a liter beaker and the hydrate precipitate is redissolved in HCl and reprecipitated as before (not forgetting the bromine water, if necessary) in a rather smaller bulk, combining the two filtrates.

Iron—The hydrate precipitate is either redissolved in dilute H_2SO_4, the iron reduced and titrated cold with standard potassium permanganate, or the precipitate is dissolved in HCl, reduced and titrated with standard potassium bichromate.

Lime—To the combined filtrates 20-30 c.c. of a 2% solution of ammonium oxalate are added, the solution is brought to a boil and allowed to stand in a warm place for half an hour, by which time the calcium oxalate should be settled out and the solution clear. The calcium oxalate is filtered off, washed thoroughly, dissolved in warm dilute sulphuric acid, diluted with hot water and titrated hot with standard potassium permanganate.

Zinc—The filtrate from the calcium oxalate is acidified with HCl, adding 5 c.c. in excess. A current of H_2S is passed through it for 5-10 minutes, the solution is then boiled for five minutes, filtered if necessary (usually this is not the case), cooled to about 30° C., and titrated with standard potassium ferrocyanide. The second portion is allowed to stand until cold in order that the lead sulphate may separate out and settle. It is then filtered, washing by decantation with cold water, adding a little dilute H_2SO_4 to the wash water from time to time.

Lead—To the residue in the beaker are added 5-10 grams of ammonium acetate, a little acetic acid and 100 c.c. of hot water. The filter paper is dropped into it and the beaker placed on the hot plate, brought to a boil, and, when all the lead sulphate is dissolved, about another 100 c.c. of hot water is added, and the solution is titrated hot with standard ammonium molybdate.

The filtrate, to which a little strong HCl may be added, is heated to near boiling and a current of H_2S is passed for 10 minutes. The sulphides are filtered off, using a rapid filter and washed with hot water (H_2S water should be used if the filtrate comes through at all cloudy, but this is rarely the case).

Copper—The sulphides are washed back into the beaker, opening out the filter paper and placing it on the side of the beaker; a few drops of bromine water are poured over it to oxidize the traces of sulphides retained in the pores of the paper; then 5 c.c. of HNO_3 and a little hot water, and the paper is removed. A small quantity of iron is added, about 0.05 gram, the beaker is placed on the hot plate and boiled down to dryness. After cooling, 2 or 3 c.c. of HCl are added, and the copper estimated by the permanganate method.

Alumina—The filtrate from the sulphides is boiled to expel H_2S, oxidized with 2 or 3 c.c. of HNO_3, a slight excess of NH_4OH is added, and the solution boiled until it no longer smells of NH_4OH. After standing a minute or two to settle, the hydrates are filtered off, washed slightly, washed back into the beaker and redissolved in a little HCl, pouring the acid first over the filter paper. The solution is just neutralized with NH_4OH, 2½-3 c.c. of HCl are added, and the alumina is estimated by the phosphate method.

Sulphur—On siliceous and burnt ores, 1 gram is taken, on pyritic ores ½ gram, moistened with water and about 5 grams $KClO_3$ and 10 c.c. HNO_3 added. The assay is taken to near dryness on the hot plate, avoiding baking, taken up with 5-10 c.c. acetic acid (1:1) and 150-200 c.c. of hot water; about 10 grams of ammonium acetate are added, the solution is brought to a boil and titrated, boiling, with standard barium chloride.

Examination of "Insoluble" Silica

When the "insoluble" is white, as in treating most raw ores and others easily attacked by acids, the residue obtained in the first part of the analysis is fused in a platinum dish or crucible with 10 times its weight of fusion mixture (K_2CO_3 and Na_2CO_3). The melt is dissolved in HCl, transferred to a porcelain capsule or casserole, taken to dryness on the hot plate, taken up with 5-10 c.c. HCl, diluted, and the silica filtered off, dried and ignited. After cooling in a dessicator the SiO_2 is weighed and an addition made for the SiO_2 still left in solution. The filtrate from the SiO_2 is rendered slightly ammoniacal, the solution boiled until it no longer smells of NH_4OH and, after standing a few minutes, the hydrates are filtered off, washing thoroughly with hot water. The filter and contents are dried, ignited and weighed, reporting as Al_2O_3 and Fe_2O_3.

When the insoluble is black or red, as in treating burnt ores and substances not easily attacked by acids, the residue is fused as above and the SiO_2 filtered off, ignited and weighed. The filtrate is tested for Cu and Pb by passing H_2S. If any is found, the sulphides should be filtered off, dissolved in HNO_3 taken to fumes with H_2SO_4, diluted and cooled; the $PbSO_4$ is filtered off and added to the main portion and the copper in solution also added to the main portion obtained in the first part of the analysis, before precipitation with ammonium sulphocyanide. (The free sulphuric acid should be just neutralized with NH_4OH).

The filtrate from the sulphides, or from the silica in absence of Cu and Pb, is boiled to expel H_2S, oxidized with HNO_3 or $KClO_3$. NH_4OH is added until the solution darkens, or, in absence of much iron, until the solution is only faintly acid, and 5-10 grams of sodium acetate are added. The solution is brought to a boil, allowed to stand and

the precipitated basic acetates of iron and alumina are filtered off.

After washing with hot water the acetates are washed into a porcelain dish, about 1 in. of caustic soda or potash added, and digested at a gentle heat for a quarter of an hour. The Al_2O_3 goes into solution, the iron precipitate is filtered off, redissolved, reduced and titrated as in the first part of the analysis. The filtrate is acidified with HCl and the Al_2O_3 either estimated by the phosphate method or a slight excess of NH_4OH is added, boiled off, the precipitate filtered off, dried, ignited and weighed as Al_2O_3. (If the quantity of iron and alumina is large, the acetates should be dissolved in HCl and reprecipitated with NH_4OH, boiling off excess before extracting with caustic, but usually this can be omitted.)

Lime—To the filtrate from the acetates about 10 c.c. of NH_4OH and 20 c.c. of a 2% solution of ammonium oxalate are added, and the calcium oxalate precipitated and filtered off. This precipitate is dried and ignited, weighing as CaO; it should be tested for iron, and, if any is found, the weight of Fe_2O_3 is subtracted from the CaO, and the calculated amount of Fe added to that previously found.

Zinc—The filtrate from the lime is acidified, gassed, boiled, cooled and titrated with standard potassium ferrocyanide.

Method for Slags

The sample should be chilled—this is usually done at the furnace, the molten sample of slag being poured into a bucket of water. Otherwise the slag in lump form may be heated to redness in the muffle and thrown into water before grinding, the effect being to make the slag easily attacked by acids, anything up to 50% SiO_2 giving a white insoluble containing not more than 1 to 2% of substances other than silica.

For the analysis, two ½-gram samples are weighed into 300-c.c. beakers or casseroles. The slag is moistened with 2 to 3 c.c. of water, the beaker is held over a spirit lamp, keeping the contents in motion, and when near boiling 3 c.c. of strong HCl are added and a few drops of HNO_3. The heating is continued for 2 to 3 minutes, when gelatinous silica separates out and the beaker may be placed on the hot plate and taken to complete dryness.

Insoluble—The two portions are taken up with 5 c.c. HCl diluted to about 100 c.c. with hot water, and the insoluble filtered off (use of the filter pump is unnecessary if the SiO_2 has been properly dehydrated), dried, ignited in the muffle and weighed.

Filtrate (1) is diluted to about 300 c.c. with hot water, about 10 grams of NH_4Cl are added and bromine water, if manganese is present, and then NH_4OH in excess. The solution is boiled, the precipitate allowed to settle, then filtered into a liter beaker, washing with hot water, the hydrates are redissolved in HCl, NH_4Cl and bromine water (if necessary) added, reprecipitated with NH_4OH and filtered off, combining the two filtrates.

Iron—The hydrate precipitate is redissolved in dilute H_2SO_4, reduced and titrated with standard permanganate, or HCl may be used, and the solution, after reduction, titrated with bichromate.

Lime—To the combined filtrates, which should be strongly ammoniacal, 20 c.c. of a 2% solution of ammonium oxalate are added, the solution brought to a boil, and allowed to stand in a warm place until the calcium oxalate settles. This is then filtered off, washed, dissolved in dilute H_2SO_4 and titrated hot with standard permanganate.

Zinc—The filtrate from the lime is acidified with HCl, adding 5 c.c. in excess, a current of H_2S is passed for 5 to 10 minutes, and the solution is boiled, cooled to about 30° C., and titrated with standard potassium ferrocyanide.

Alumina—Filtrate (2) is just neutralized with NH_4OH, 2 to 3 c.c. of HCl are added, and the alumina estimated by the phosphate method. If much Cu and Pb, etc., are present, the filtrate should be gassed, filtered, H_2S boiled off and the solution oxidized before proceeding as above; but the author has not found this to be necessary in dealing with ordinary slags.

Copper—For copper, 5 grams are weighed into a 600-c.c. beaker, about 250 c.c. of hot water added, and the beaker placed on the hot plate. When boiling, 30 c.c. of strong HCl are carefully added and the solution stirred until decomposition is complete. If pure acid has been used, the sulphides of Cu, etc., which are not attacked, can be filtered off, but it is safer to pass H_2S for a few minutes before filtering. The sulphides are washed back into the same beaker, cleaning the paper with bromine water, and dissolved in HNO_3. The copper is then usually estimated by titration with cyanide or colorimetrically. A more accurate, though rather longer, method is to take to complete dryness, take up with HCl, and estimate the copper by the permanganate method.

Interferences and Sources of Error

Lead and lime are both present as sulphates after taking down the assay to white fumes with sulphuric acid, and it is difficult, if not impossible, to effect a satisfactory separation by washing out the $CaSO_4$. This difficulty is avoided in the method suggested by doing the lead and the lime on separate portions; keeping back all the lead and a little lime in one, and dissolving all the lime and most of the lead in the other.

As manganese interferes, it must be removed before the zinc titration. Small quantities of manganese, say up to one-fourth the iron present, can be thrown down with the hydrates by adding bromine water before adding NH_4OH to the solution. In case the hydrate precipitate is almost black, the acidified filtrate should be tested by adding more bromine, and making alkaline again. Manganese does not appear to interfere with the estimation of lime by permanganate, nor does oxalic acid interfere with the zinc titration.

Phosphate Method for Alumina

To a cold, neutral, oxidized solution of the bases, freed from large quantities of As, Sb and Cu, 2 to 3 c.c. of HCl solution containing 2 grams of sodium phosphate and 10 grams of sodium hyposulphite are added, then 15 c.c. of acetic acid (glacial acid one part, water one part). The solution is made up to about 300 c.c., boiled vigorously for 20 minutes, filtered, washed with hot water, ignited in the front of the muffle and weighed as $AlPO_4$.

$$Al_2O_3 = AlPO_4 \times 0.4185.$$

(2) *Extraction by caustic*—To an acid solution of the bases a slight excess of NH_4OH is added and the solution boiled until it no longer smells of ammonia; the precipitated hydrates are filtered off, washed, and then washed back into a glazed porcelain dish; 1 to 2 in. of pure stick caustic soda or potash are added, and the dish placed in a warm place for a quarter of an hour. The solution is then filtered through the same paper. Al_2O_3 passes through into the filtrate. The filtrate is acidified with HCl, a slight excess of NH_4OH added, the solution boiled until it no longer smells of ammonia, and the precipitate filtered off, washed well, dried, ignited and weighed as Al_2O_3.

With small quantities of alumina and large amounts of zinc, lime, sulphates, etc., in the solution, the phosphate method is apt to give erratic results. Under these conditions it is safer to throw down the hydrates, redissolve in 2 to 3 c.c. HCl and then add the phosphate, etc. The extraction method is more tedious, but gives good results on small quantities of Al_2O_3. If more than 0.05 gram of Al_2O_3 is present (10% in ½ gram assay) the aluminum hydrate should be redissolved and reprecipitated or the two methods may be combined, extracting with caustic, acidulating the filtrate with HCl, adding 2 c.c. in excess and then the phosphate, etc.

Copper in large quantity is thrown down by the hyposulphite and brings the results high. Smaller quantities (as in slags) do not interfere, probably being kept in solution as acetate. When thrown down, Cu colors the $AlPO_4$ blue or black, according to quantity. Lead and manganese in ordinary quantity do not interfere. Arsenic and antimony, when in considerable quantity, are thrown down and color

the precipitate, which, however, burns white. Results come a little high.

Permanganate Method for Copper

The copper is brought into a solution containing 2 or 3 c.c. free hydrochloric acid. If in nitric solution, it must be taken to dryness, and taken up with HCl. If in sulphuric, the solution is neutralized with NH_4OH and 2 or 3 c.c. HCl added. If much insoluble is present this is filtered off; a little iron (about 0.05 gram) should be added if none is present, as in treating a sulphide precipitate or in standardizing.

The bulk of the solution should be 150 to 200 c.c. To this is added 20 c.c. of a 10% solution of sodium sulphite (it is convenient to filter the solution into a beaker containing the sulphite) and then 5 c.c. of a 10% solution of ammonium sulphocyanide. The beaker is placed on the hot plate and brought to a boil, by which time the solution should be decolorized; otherwise more sulphite is added After boiling a few minutes, the solution is filtered through a double close-grained filter paper and washed three times with hot water. The funnel is then placed over a flask and washed with a hot 8% solution of caustic soda or potash. The beaker in which the precipitation was performed is also washed with caustic, and the washings poured through the funnel. The precipitate in the funnel is now washed three times with hot water, filtrate and washings made up to about 300 c.c. with cold water, acidified with dilute H_2SO_4, adding at least 10 c.c. in excess, and titrated cold with standard permanganate (5.7 grams per liter. 50 c.c. = 0.1 gram Cu).

The same permanganate solution is used as for iron, the copper value of the solution being five times the iron value, but it is well to standardize on electrolytic copper. Water, acid and caustic solution used should be tested for anything which would affect permanganate. The advantage of adding iron to the checks and sulphide precipitates is shown by the following experiment: (0.2 gram Fe required 19.9 c.c. permanganate.) 0.1 gram Cu required 49.5 c.c.; 0.1 gram Cu + 0.1 gram FeS_2 required 50.3; 0.05 gram Cu required 24.6 c.c.: 0.05 gram Cu + 0.1 gram FeS_2 required 25.0; 0.025 gram Cu required 12.0 c.c.: 0.025 gram Cu + 0.1 gram FeS_2 required 12.5. The iron is conveniently added as FeS_2 when the copper or sulphide precipitate is being dissolved in HNO_3, but iron wire or any pure iron salt will do equally well.

Permanganate Method for Iron

The sulphuric-acid solution of the iron, which must be free from HCl and even traces of nitrates, is warmed with 10 to 15 grams of pure granulated zinc until a drop of the solution removed on a glass rod and added to a drop of ammonium-sulphocyanide solution on a white plate, remains colorless or only gives a faint pink tinge. The solution is then poured through a rapid filter into a flask, cooled, made up to about 500 c.c. with cold distilled water and titrated with standard permanganate. The reduction is best made in a solution containing only a little free acid; 10 c.c. of 1:3 acid is usually enough, but more acid must be added if the reaction slackens before reduction is complete; 20 c.c. more 1:3 acid should be added before titration.

In reducing with H_2S, the sulphuric-acid solution of the iron, which must be free from much HCl (traces of nitrates do not interfere), is gassed with H_2S for 10 minutes. Reduction is most rapid in faintly acid solutions—a large excess of acid should be nearly neutralized with NH_4OH; the solution is boiled for about 10 min. and tested by holding a piece of filter paper saturated with lead-acetate solution in the issuing steam. When no blackening of the paper occurs, the beaker is removed from the hot plate and the solution filtered into a flask containing about 20 c.c. dilute H_2SO_4, tested for ferric iron with ammonium sulphocyanide, cooled, made up to about 500 c.c. with cold distilled water, and titrated with standard permanganate.

Bichromate Method for Iron

For the bichromate method, the iron in hydrochloric solution, containing about 5 c.c. free HCl, should be warm and concentrated. It is carefully reduced with a solution of stannous chloride (15 grams Sn, 350 c.c. HCl per liter) added from a burette and performing the reduction over a white plate. When colorless, two drops of the $SnCl_2$ solution are added to make sure of having a slight excess, the solution is diluted with cold distilled water to about 300 c.c., 10 c.c. of a saturated solution of mercuric chloride are added (giving a white, cloudy precipitate) and the solution titrated at once with standard potassium bichromate (4.4 grams $K_2Cr_2O_7$ per liter, 20 c.c. = 0.1 gram Fe), using a 1% solution of potassium ferricyanide as indicator. Spots of the indicator are placed on a white plate, and, after mixing each addition of the bichromate with the solution, a drop is withdrawn and added to one of the spots on the plate. A dark blue color at first appears, gradually becoming fainter as the oxidation proceeds. Failure to color after standing half a minute shows the end point. It is to be noted that a small spot of ferricyanide should be taken for the final test.

The solutions of permanganate or bichromate are standardized by taking a weighed quantity of piano wire, or ferrous ammonium sulphate, and treating exactly as the assay. The piano wire usually supplied may be taken as containing 99.5% pure iron, ferrous ammonium sulphate as containing $^1/_7$ its weight pure iron.

Comparing the three methods, the H_2S-permanganate is probably the safest, removing as it does most, if not all, sources of interference. The Zn-permanganate method is commonly used; care must be taken in testing the zinc used, and also that the solution is free from any trace of nitrates; the hydrates precipitated from a solution containing nitric acid carry down sufficient nitrate to interfere with the assay if simply dissolved in dilute H_2SO_4.

The $SnCl_2$-bichromate method is the quickest, but requires more attention in reducing and titrating than does the permanganate; a good light is essential. In most ores the small quantities of impurities carried down by the hydrate precipitate do not interfere with this method; it should be checked, however, against the H_2S permanganate.

Lead—Molybdate Method

Sulphate of lead, thrown down and filtered off as described in the analysis, is dissolved in a hot solution of ammonium acetate, slightly acidified with acetic acid. Spots of a freshly prepared solution of tannic acid are placed on a glazed porcelain plate, and the assay titrated hot with standard molybdate (9.5 grams per liter, 10 c.c. = 0.1 gram Pb), withdrawing a drop after each addition of the standard solution, and adding to a spot of tannic acid on the plate. The end point is shown by the appearance of a yellow color.

The basic sulphate of iron formed in the course of the analysis is soluble with difficulty; insufficient boiling after dilution and insufficient washing of the residue result in leaving some iron with the $PbSO_4$; this gives a black color with the tannic acid, spoiling the assay. The molybdate solution may be standardized on pure lead or on pure lead acetate, of which 0.183 gram = 0.1 gram Pb.

Lime—Permanganate Method

Calcium oxalate, thrown down and filtered off as described in the analysis, will carry down an appreciable amount of magnesium oxalate, if much MgO is present. In this case it should be redissolved and reprecipitated.

The filter paper containing the pure calcium-oxalate precipitate is opened out, and the precipitate carefully washed back into the beaker with a jet of hot water. The paper is then placed on a large clock glass, and 10 c.c. of dilute H_2SO_4 (1:3) are poured on it; after a minute or two the acid is poured off into the beaker containing the bulk of the precipitate and the paper washed with hot water. A second treatment with acid and hot water will remove all the oxalate from the paper. The assay is brought to a boil, and when all the calcium oxalate has dissolved, the

solution is diluted to about 300 c.c. with hot water and titrated hot with standard permanganate.

Insoluble

The insoluble obtained after attacking the ore with acids (after washing with ammonium-acetate solution to free it from any traces of lead sulphate) is fused in a platinum dish or crucible with ten times its weight of fusion mixture (K_2CO_3 + Na_2CO_3). After cooling, the melt is moistened with a few drops of water and 2 to 3 c.c. of strong HCl, keeping carefully covered with a small watch-glass. When the action of the acid has nearly ceased, the liquid is washed out into a porcelain capsule or casserole, and the process repeated. In this way the whole of the melt can be dissolved and transferred to the capsule in a few minutes, and the bulk of the solution should not exceed 100 c.c. The capsule is placed on the hot plate and boiled to dryness—care must be taken to avoid spitting just at the moment when the salts are solidifying. When completely dry, as shown by the absence of condensing moisture on the cover glass, the capsule is removed from the hot plate and allowed to cool. About 10 c.c. of HCl are added, 50 to 100 c.c. of hot water, and, after bringing to a boil to dissolve everything soluble, the residue is filtered off, washed, dried, ignited and weighed as SiO_2.

A small amount of SiO_2 remains in solution after this treatment, and can be recovered, by a second and third evaporation to dryness. An allowance can be made for this of: 1% on the SiO_2 found, if more than 50%; 2% on the SiO_2 found, if between 10 and 50%; 4% on the SiO_2 found, if less than 10%.

Sulphur—The standard solution is barium chloride, 38 grams per liter, 20 c.c. = 0.1 gram S. Either 0.5, or 1 gram of ore, according to its richness in sulphur, is weighed into a 600-c.c. beaker, 5 to 10 grams of $KClO_3$ are added, 5 to 10 c.c. of water, and 10 to 15 c.c. of strong HNO_3. The assay is heated, gently at first, and afterward boiled down to near dryness. Ten cubic centimeters of 1:1 acetic acid and 5 to 10 grams of ammonium acetate are added, about 250 c.c. of hot water, the beaker is placed on the hot plate, brought to a boil, and the assay is ready to titrate.

Three cubic centimeters of HCl may be used instead of the acetic acid, and if the assay has been taken to complete dryness, it gives better results, as basic sulphates are formed which are soluble with difficulty in the acetic-acid solution. The acetic acid seems to give a slightly clearer end reaction, but the difference is small.

For the titration the solution should be boiling, and the beaker is kept over a small spirit lamp. Spots of $BaCl_2$ solution and of dilute H_2SO_4 (about 9 c.c. strong H_2SO_4 per liter) are placed in parallel rows on a glass plate, supported about 6 in. above a dark surface. After each addition of $BaCl_2$, a small portion of the solution is withdrawn by means of a glass tube, dropped into a filter and from the filter on to two of the spots on the plate. At first a dense precipitate shows in the $BaCl_2$ spot, gradually fading as the titration proceeds. Finally, a slight cloudiness appears in both spots and when this is equal in intensity, the assay is finished. A few more drops of $BaCl_2$ may be added and another test should show a distinctly denser precipitate in the H_2SO_4 spot. The $BaCl_2$ solution may be standardized on pure ferrous ammonium sulphate; 0.613 gram of this salt, containing 0.1 gram of sulphur, is weighed out and treated exactly as the assay.

The above treatment with HNO_3 and $KClO_3$ leaves $BaSO_4$ undecomposed; ores which contain this substance should be mixed thoroughly with about 10 times their weight of a mixture of 1 part Na_2CO_3 and 4 parts ZnO, placed in a porcelain crucible and covered with a gram or so of the mixture.

The crucible is heated to redness for a quarter of an hour, cooled and the mass extracted with water and washed; the filtrate is acidified with HCl, adding about 3 c.c. in excess, boiled a few minutes until all CO_2 is expelled and the sulphur estimated either gravimetrically or volumetrically. The volumetric method gives excellent results, the end reaction in this modification being especially distinct.

The end point may seem a little doubtful at first, but practice will enable it to be determined with certainty within 0.2 c.c. and concordant results obtained.

Zinc—Ferrocyanide Method

The standard solution is potassium ferrocyanide 43.1 grams per liter; 10 c.c. = 0.1 gram Zn. The ammoniacal filtrate from the iron in which lime has been estimated, may contain copper, antimony, etc., but not manganese, and is acidified with HCl, adding 5 c.c. in excess. H_2S is passed for 5 to 10 min. and the solution boiled until H_2S is expelled. It is then titrated with standard potassium ferrocyanide, using spots of uranium acetate solution (8%) on a white plate as indicator. The temperature of the solution may be near boiling if oxalates are absent, but if present the temperature should not exceed 30° C.

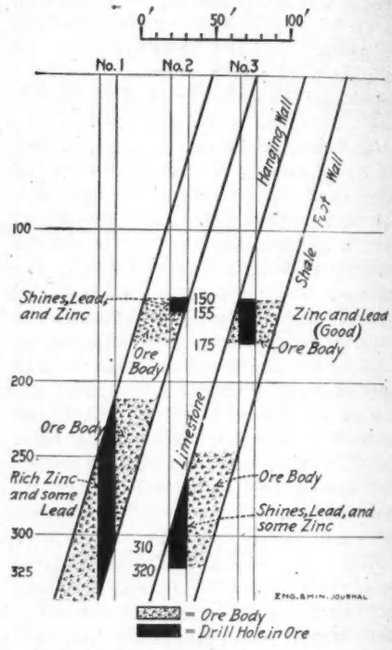
The thorough gassing of the solution before titration is important, and should never be omitted.

It is reported that a Swiss syndicate has secured a number of mining claims at St. Joachimsthal and incorporated a company at Zurich under the name of Société Minière de Radium de St. Joachimsthal, S. A., for the purpose of extracting, working and selling radioactive and other mining products. The authorized capital is 500,000 francs.

The Miami Zinc-Lead District, Oklahoma

By Temple Chapman*

In the Journal for Dec. 23, 1911, there appeared a graphic article on the Oklahoma Lead and Zinc Fields. The development of the Miami (Okla.) camp accentuates the parallel-channel occurrence of the groups of orebodies which constitute the camps of the Joplin district. The accompanying map shows the ore occurrence by camps from Carthage on the east to Miami on the west. The Oronogo-Webb-Duenweg camp has been the most vigorously mined for the longest time, and therefore its once isolated mines have become a solid chain of workings



Section through Deep Drill Holes, Miami Camp, Oklahoma

10 miles long by two miles wide, and with greater length indicated by new discoveries beyond both ends. The Miami camp is even more regular in its range of ore, although not yet developed one-tenth as much in time or area as the Webb City camp.

Knowledge of Trend of Ore Systems Important

Of course, the practical value of knowing the general trend and occurrence of ore is that thereby we may do our exploratory work and "wild-cat" prospecting in regions which, though yet virgin, lie within definitely marked ore ranges, and are therefore reasonably likely to have ore. In a level farming country like the Joplin district, where no ore protrudes and there are no surface indica-

*Mine operator, Webb City, Mo.

tions to guide the prospector, a practical and trustworthy theory of geological formations and trend of ore systems is of great importance.

Many Small Operators

Our individual mines here are said to be short-lived (due in part to cutting up one orebody into a number of small leases worked by different companies), but our main ore systems are now known to contain extensive masses of ore, requiring many years to work out. It might here be said that had this region been exploited by big, modern companies owning the land, instead of by small companies leasing it, some of such companies would have found themselves possessed of great bodies of ore, comparable in extent with the lead mines of southeast Missouri or the great porphyry copper mines.

While the Miami ore development is a guide to the rest of the district because of the emphasis it puts upon the regularity of the parallel "ten-o'clock" ore ranges, it also has its own peculiar features. An accompanying engraving gives a conventional vertical cross-section of one of the Miami ore channels. The Miami prairie has a clay soil and is flat as a pancake. When the first mines were opened and showed the same kind of ore at the common level, about 100 ft., it was supposed that the ore was of a blanket formation. Much shallow drilling (deep as the then workings) was done, which missed the ore. After a couple of years' work, it began to be noticed that the ore lay in regular channels or veins, which pitched to the north. Drilling then began to be done deeper and ore was found first to 250 ft. and then to 300 and 350 ft. in depth, but still apparently connecting with the first shallow mines.

Drilling Results Variant

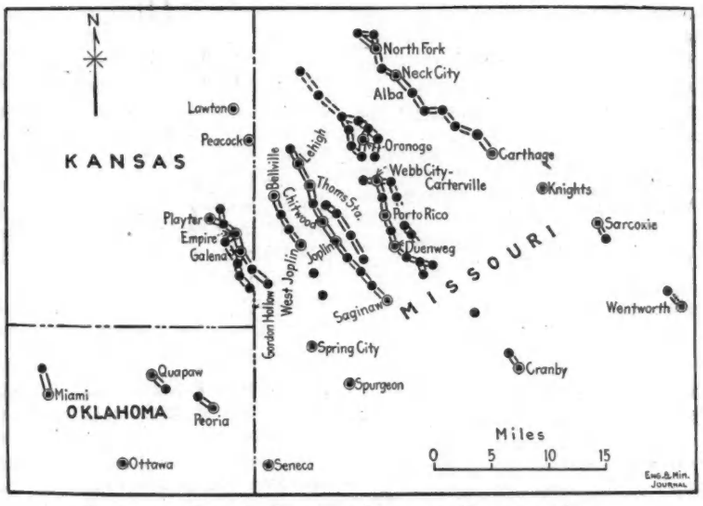
This section also illustrates a difficulty in drilling which arose from finding such widely varying results from holes bored vertically and close together, viz., 30 ft. apart, which struck ores varying 100 ft. in depth and very different in metal content. The sketch shows how holes placed at 30-ft. intervals across the known course of an ore run might thus vary in character. Miami being a new camp and yielding such peculiar drill results (often phenomenally rich in zinc and lead), it has been necessary to do a large amount of drilling to instill full confidence in the new "deep-level" companies, who must be prepared to both sink deep and take care of a large and not fully understood water problem. The character of the shale found next to the ore has helped greatly in shaping plans to conquer the water problem.

Co-operative Drainage Would Be Advantageous

From the beginning of the camp, it was found that if one pumping station lowered the water at its shaft to a certain depth, the water level all through the camp would stand at that level. Also, the volume of water pumped from a deeper level seems to be no greater than the volume that had been the normal flow at a shallower level. Before any mining was done a sulphur spring existed near the south end of the present camp, and this has been slowly lowered until it now stands at 210 ft. below the surface. Although the pumping has drained a large saturated area, there is no water in the vast bodies of shale which lie around and over the open ore channels.

When drilling showed the confines of the ore and the situation of the deep beds of shale, it became practical to sink shafts in this dry, water-tight shale to a depth equal to the bottom of the ore and 100 ft. below the water level; to arrange pump chambers and install pumps; and to avoid cutting into the ore until the pump equipment was ready to handle the water that would be encountered with the ore.

By installing a good triple-expansion steam pump, with a capacity of several thousand gallons per minute from 330 ft. depth (bottom of developed ore) the water of the whole camp can be easily taken care of. With the growth of the camp now in sight and the consequent future milling demand for water, there is not likely to be more than enough water to go around, and some equitable system of sharing the cost of pumping the water from a single pump station is likely to be evolved.



Zinc-lead Fields, Showing Parallel Runs of Ore

While there is an unusual similarity of formation, ore occurrence and direction, water flow, etc., throughout the Miami camp, there is also an equally remarkable regularity of lead and zinc yield from the different mines along the main ore channel. The ore from the whole Joplin district might be classed as a 4 to 6% ore, which, with a 66% recovery, yields 2.5 to 4%. By actual measurements of the Miami mine workings, the tailing piles, the weights of concentrates sold, and assays of losses in tailings, the following results are reported by Mr. Church, an engineer actively connected with the camp: Zinc and lead in crude ore in place, 24%; concentrates recovered, 16%; loss in tailings, 8%; proportion recovered, 66%. Average commercial value of ore in place as since extracted, $5 per ton. The royalties in Miami have been high and so have the costs, each averaging about $1.50 per ton. This leaves to the operator a profit of $2 per ton on rock mined, with nearly as much more to the landowner and other royalty recipients. The gross value of ores mined in other parts of the Joplin district hardly average $2 per ton.

Many Similarities Throughout District

The larger operations now under way in the Miami camp will undoubtedly yield such good results as to attract many prospectors in the near future, and by them a larger area of ore will be found than has yet been indicated. The camp is fortunate in having good American labor, railroad facilities, mining supplies, good water and cheap natural gas and coal.

The extension of the Miami channel workings and the constant spreading out of the workings of the Webb City and other sheet-ground areas, should afford data upon which the geologists may develop working theories valuable in the exploration of the still large undeveloped areas of the Joplin district. Until quite recently, scientific men have had little else than small, isolated, soft-ground "diggins," maybe muddy and timbered, which disclosed but sparingly the earth's interior, from which to form their hypotheses, and thus their theories of ore deposition have been of slight practical help or importance to the district.

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

Frank Nicholson, of Joplin, Mo., is visiting New York.

Albert Burch, of San Francisco, is in Nevada on professional work.

Fred T. Williams has been in California and Arizona on a combined business and pleasure trip.

Eli T. Connor expects to make a professional trip this week to Newfoundland, where he will be for a week or 10 days.

H. R. Conklin, manager of the Lluvia de Oro Mining Co., was a visitor in New York this week. He will shortly return to Mexico.

Reginald E. Hore has returned to Houghton, Mich., after a visit to the Cobalt silver mines, and the Sudbury nickel mines in Ontario.

S. R. Guggenheim has been chosen a director of the International Pump Co., in place of Benjamin Guggenheim, who was lost on the "Titanic."

James Jacoby has resigned as manager of the Ely Central Mining Co., to look after his personal mining interests. He will have his headquarters at Denver.

Thomas A. Varden, of Butte, Mont., has been making an examination of two silver-lead properties in the Warm Springs district, near Helena, Mont., the past month.

H. W. Hardinge left New York on June 1, for Norway and Sweden, by way of London. Before returning he will visit the iron mines north of the Arctic Circle in Norway.

Ernest Levy, manager of Le Roi No. 2, Ltd., at Rossland, B. C., returned from England last month. Work is progressing on the mine, but no new developments are reported.

Godfrey Hughes has been appointed consulting engineer and metallurgist to the Orient Coöperative Mining Club, of Spokane, Wash., and will establish an assay office and laboratory there.

George L. Holmes, of San Francisco, has completed the remodeling of the gold-saving tables of the Cache Rock dredge, operating in the stream of the middle fork of the American River, California.

W. R. Crane, dean of the School of Mines of the Pennsylvania State College, will leave for Alaska about June 15, and will spend the coming year studying the mineral resources of that country.

G. Caetani, of San Francisco, has returned from a professional visit in Colorado, where he remodeled the mill at the Smuggler mine, in Marshall basin, near Telluride. He is remodeling the Tomboy mill in the same camp.

Samuel D. Warriner, has been chosen president of the Lehigh Coal & Navigation Co., in place of the late William A. Lathrop. Mr. Warriner has been for some time past vice-president of the Lehigh Valley Coal Co., and is well known in the anthracite country as an engineer.

W. B. Pattison has been appointed superintendent of the Breiting mines at Humboldt and Negaunee, Mich., to succeed Capt. Hodgson, who has gone to the Copper Queen in Ariona. Mr. Pattison has been assistant to Capt. Hodgson, and is a graduate of the Michigan College of Mines.

August Thyssen, now the most prominent figure in the German iron trade, celebrated his seventieth birthday, May 17, and the German newspapers devoted much space to sketches of him. He is the creator of the great iron and coal establishment Deutscher Kaiser, and director in other steel and coal companies.

E. F. Lake, consulting metallurgist, Bayonne, N. J., has merged his business with that of Nixon & Raab, and the consolidation will be known as Lake, Nixon & Raab, with office at 156 Fairview Avenue, South Orange, N. J. This firm will specialize in the heat treatment of steel and in the treatment of other metals and alloys.

Dr. Eugene A. Smith has retired from his position as professor of geology and dean of the Engineering Faculty of the University of Alabama. He has been connected with the university for 45 years. Dr. Smith will devote his time to his duties as state geologist of Alabama, a position he has filled most acceptably for many years.

Howland Bancroft has resigned from the United States Geological Survey with which he has been connected since 1907, and will enter practice as a consulting mining geologist. He will make a specialty of economic geology and the commercial possibilities of metalliferous deposits. His headquarters will be at No. 730 Symes Building, Denver, Colorado.

The American Metal Co. on June 1, 1912, celebrated its 25th anniversary by a series of festivities in which its staff participated and with special honors to Mr. Jacob Langeloth and Mr. Berthold Hochschild, who have been connected with the company since its organization. The senior members of the staff received gold badges, of a design following the seal of the company, with the addition of the words *"Labor, unitas, fidelitas."*

Charles Hartman Jr. and Fred P. Walters of the U. S. Geological Survey returned from Middle Fork cañon of Feather River to Sacramento, Calif., on May 29 by way of Oroville. They left Oroville in April with 10 other survey men. The 10 other men were unable to complete the proposed trip and before reaching Bald Rock cañon made their way out to Nelson Point. Hartman and Walters continued alone, without the pack animals, which had been sent back before the party was broken up. In Devil's cañon they discarded all cumbersome baggage, including blankets, retaining only necessary clothing, and beans, coffee and rice actually essential to subsistence.

OBITUARY

Marion Aubury, mining engineer, died of typhoid fever, at Yuma, Ariz., May 28. He was born in Sacramento, Calif., and was 52 years old. He was instrumental in the opening of the Bodie mine, in Mono County, Calif., and of mines at Tombstone, Ariz. At the time of his death he was connected with the Federal reclamation work, near Yuma. He was a brother of Lewis E. Aubury, former state mineralogist of California.

Societies and Technical Schools

Mine Inspectors' Institute of the U. S. A.—The fourth annual meeting will convene at Columbus, Ohio, June 18, and conclude June 21. The executive committee will hold a business meeting on June 17. All members of the institute as well as all state, territorial or provincial mine inspectors in North America are invited to attend the meeting and those not now members are invited to present their applications for membership. The Ohio inspectors have made extensive provision for the entertainment of those who may attend, and the meeting has promise of being the most successful of any yet held.

International Society for Testing Materials—The Organizing Committee, under whose auspices the congress will be held, makes provisional announcements regarding the details of preparation for and program of the congress. The congress will be held in the Engineering Societies Building, New York, during the first week of September. On Sept. 2, the headquarters will be open for the registration of members, acceptance of the credentials of the delegates, assisting foreigners and strangers to the city to secure lodgings, etc. In the evening there will be an informal reception, under the joint auspices of the American Society for Testing Materials, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Institute of Mining Engineers. On Sept. 3 the congress will convene at 10 o'clock, at which time there will be an address of welcome by the acting president of the International Association, Dr. Henry M. Howe, and by national, state and municipal officials. The various sections will then arrange for their sessions, which will last three days. A large number of papers have been received and are being printed.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

May 29—It now appears that the $18,000,000, bond fund, voted for by the people of California and appropriated by the legislature for the construction of state highways is inadequate. At any rate it will not be sufficient to give certain counties the laterals they were led to believe would be a part of the system. The tentative plan is to build two highways extending north and south through the state, one on each side of the coast range of mountains. The plan contemplates the omission of the mining counties along the westerly line of the Sierra foothills, notably the Mother Lode counties. The promise seemed to be assuring, when the counties were asked to vote, that every county seat in the state would be tapped either by the main highway or by laterals. There is some chance that Tuolumne County may be given a lateral from Sonora to Stockton and it is possible that Nevada and Shasta counties may be on the main line or connected by laterals. But the indications at present are that the mining counties generally will not be benefited greatly. However, much depends upon the activity of these counties in demanding a just apportionment of the moneys. There is no industrial section of California that stands in greater need of public highways than the metal-mining districts. In many of the districts poor road building has been done. There is no lack of good road material within easy reach of the roadways, and this is true of almost every mining district in the state. In some districts an attempt has been made to build oil and macadam roads, and in many instances the roads have been failures, because of improper construction. The introduction of automobiles is having an influence for better road building. At present an effort is being made by mining men and others in Inyo County to join the mining and commercial associations of Goldfield and Tonopah in support of a transcontinental auto route which will extend from Utah through Nevada, via. White Pine, Nye and Esmeralda Counties in Nevada and through Inyo County across the White Mountains to connect with the road south to Los Angeles.

Charles W. Eberlein, former land agent of the Southern Pacific R.R. Co., has proved a valuable witness for the government in the suit brought to cancel the railroad landholdings in the Elk Hills, as reported in the JOURNAL of June 1, p. 1067. Mr. Eberlein declined positively to give any information to the government agents preceding the taking of testimony before Leo Longley, special examiner in the Department of Justice, and refused to produce any papers or correspondence until subpœnaed as a witness and even then refused until he had been sworn to testify. But he declared if the government legally obtained possession of any documentary evidence, he would as a sworn witness tell all that he knew. Mr. Eberlein's testimony related chiefly to the lease of the S. P. R.R. Co. lands to the Kern Trading & Oil Company.

Butte

May 29—In sinking an artesian well, a flow of natural gas was encountered on the Michael Wagner farm, near Kalispell, recently. In efforts to locate the flow of artesian water, the well had been sunk to a depth of 350 ft. when the gas was struck. It burned several hours after ignition, the flames rising several feet above the ground, and at last stopping abruptly, probably due to a cave-in of the well. It had been the contention of many for years that several sections of the Flathead Valley are underlaid by petroleum, but this was the first actual indication. Much excitement was occasioned by the discovery and quite a rush made to the district. Mr. Wagner will begin soon to sink the well to find the main gas belt.

Denver

May 30—The American Smelting & Refining Co. has just put in two Dwight & Lloyd sintering machines at its plant in Pueblo, two at Leadville and two at the Globe.

It is reported here that Fred T. Smith, of Denver, and V. C. Ward and Alfred Fossman, of Green River, Utah, have located a group of claims near the San Rafael River about 100 miles west of Grand Junction, Colo., and have taken out several cars of 12% uranium and vanadium ore which are ready for shipment.

The old project of a railway, mining and drainage tunnel through the Mosquito Range in the Leadville basin, is now being revived. The surveys, maps and engineer's reports were made years ago but until now conditions were not favorable for construction. The length would be 9¾ miles, through a proved mineral range, cutting the London and other great veins of the Alma-Fairplay district at approximately 2500 ft. below the surface, rendering it possible, by a new line of railway through South Park, to deliver Leadville ores by a downgrade haul, to Denver smelters at about one-fifth the present cost, and shortening the route between this city and California 173 miles. The owners of the tunnel property have held their rights by continuous work and have driven the tunnel 1200 ft. and are also said to have acquired mining property for two miles in length along the course of the tunnel. There are large mining possibilities in this project.

At Creede there is a great deal doing, and less is being said than of any prosperous camp in the state. There are 12,000 tons of Creede ore at the Pueblo smeltery now, and 250 tons per day of crude ore are being produced. The Triune Co., under W. F. deCamp, general superintendent, formerly in charge of the Portland mine at Cripple Creek, is building a power house and starting to sink a large working shaft below the level of the drainage tunnel in the old Amethyst mine.

At Cripple Creek the Miners Protective Association has made it necessary for all mine owners and officers as well as the miners, to have cards, and during the last seven weeks 2740 have been issued, 37 applicants being refused.

Salt Lake City

May 30—The strike at the lead plant of the American Smelting & Refining Co., at Murray, has been settled, and the furnaces are running at the same capacity as before. Five or six furnaces out of eight are in blast. The demand for an increase in wages by the unskilled foreign laborers on the charging floors and in the yards, was refused, and the matter settled by bringing in new men, and by allowing part of the American laborers to return to work. No further trouble is anticipated. Shipments are being received at the usual rate.

The International Smelting & Refining Co. is ordering material for the third lead stack at the Tooele smeltery. Arrangements were made to add a third stack if necessary, when the other two furnaces were built, and work on the foundations, etc., is in progress. The amount of lead ores being received is increasing, and new ores have been contracted for from some of the Cœur d'Alene mines. Arrangements have also been made with the

Goldfield Consolidated for certain gold ore, carrying copper and silver, which was not adapted to treatment by the Consolidated mill. The fourth reverberatory furnace is in operation on copper ores. In the copper and lead plant, combined, approximately 1000 tons per day are being smelted.

Phoenix, Ariz.

May 30—The subject of taxation of mines and products is causing some uneasiness among operators throughout the state. Some mining men, who have recently visited here, hope that a bullion tax law will be passed by the legislature, now in special session. The latest information is that no attempt will be made to pass a bullion tax bill, but that a bill providing for the assessment of mines under the "ad valorem" system will undoubtedly be adopted.

A bullion-tax law is not entirely equitable, for the cost of producing bullion varies in different places, and under different conditions. The mine owners say, however, that they prefer to pay on their bullion output rather than to have their claims assessed on the basis of ore reserves.

Porcupine

May 31—A matter of great interest to northern Ontario is the purchase of the Porcupine Power Co.'s system, by the Wawaiten Falls Syndicate. This syndicate recently purchased and undertook to complete the plant under construction by E. A. Wallberg, at Wawaiten Falls. This plant is now being rushed to completion and the contractor expects to be able to deliver power in October. The Porcupine Power Co. is the only concern supplying power in this district, and serves the majority of the mines in the Pearl Lake area. Lorne McGibbon, of the La Rose, is president of the Wawaiten Falls Syndicate and David Faskin represents the Cobalt and Haileybury interests, so that the deal embraces most of this northern country.

Chihuahua

May 26—Mexico's revolutionary status has affected the Chihuahua mining industry less than was anticipated at the outset, inasmuch as the revolutionists have generally avoided direct molestation of mines and particularly those owned by Americans or other foreigners. This does not mean that mining has not been interfered with, but that the interference has been only that which would be incidental to a similar revolution in any country. Wilful or prearranged molestation of mining properties or operations has been almost entirely absent, as was the case with last year's Maderista revolution.

Comparatively few of the larger mines have suspended. For instance, the majority of the Santa Eulalia mines are maintaining an almost normal production, as are those in the Naica, Cusihuiriachic, Dolores, Batopilas and Ocampo camps. At Parral, the San Francisco del Oro, Palmilla, Maria, Tecolotes and El Rayo companies are operative and productive, but many of the others are shut down. At Guadalupe y Calvo, as well as in the Durango camps of Indé and Guanacevi, things are practically at a standstill, and will continue so as long as disturbances exist. Along the Orient railway, east of Chihuahua, all the mines have suspended, as is the case with properties on the extension of this road west of Minaca, but these cessations are due to shortage of supplies and to the difficulty of securing additional material on account of uncertain railroad communication.

The Chihuahua smeltery of the American Smelting & Refining Co., has been in steady commission with five furnaces in blast, and has on hand sufficient ore and fuel to operate for three months at least, even though the mines should shut down or the railroad service be discontinued unexpectedly, as is the constant fear of everyone. The Terrazas copper smeltery is operating steadily.

The supply of fuel and dynamite is still a serious matter for the mines and reduction works, on account of the uncertain railroad communication and because of the attitude of the United States Government toward the exportation of explosives into this country, which might be construed as munitions of war and thus an aid to the revolutionary cause. The first of these uncertainties still exists, although communication to date has continued quite regularly over both the National and Mexico Northwestern lines to El Paso, the former road being operated from Jiminez to El Paso by the revolutionists. On several occasions the United States Government placed a ban on the exportation of both coal and dynamite, but speedily lifted it on a better understanding of the hardship thereby imposed on American-owned mines, and on adequate guarantees from the revolutionists that the goods would not be confiscated. There is now sufficient of both articles for at least two months, and as additional lots are coming in, it is not probable that operations will cease for lack of either. An idea of what the closing down of the present operative mines means is apparent when it is understood that at least 5000 men would be thrown out of employment, and these men, none of whom have enough money ahead to live longer than a week, must either take sides in the revolutionary cause or exist by looting and robbery, and in the latter case it is doubtful if the American or foreign interests generally would be greatly respected.

While foreign operators have little fear of personal violence or wilful molestation on the part of the organized forces, there is, nevertheless, an apprehension due to the uncertainty of what may happen from one day to another. With this uncertainty to guard against, it has been considered wise to send the women out of the camps, particularly those more remote from the railroad settlements. Bullion shipments to the United States are now being made via both the National and Mexico Northwestern railroads. The Cusi Mining Co. has perfected plans for the erection of a concentration-cyanidation plant, as soon as disturbances cease.

Johannebsurg

Apr. 29—The mines of the Rand are strongly opposing the provisions of the Miners' Phthisis bill, which proposes to deduct 30s. per month from wages of rock drillers and 15s. from all other underground employees. The mine owners argue that, as the government draws huge profits from the industry, they should not be compelled to bear three-quarters of the cost of the scheme. The bill has been referred to a committee for revision. There will be no compulsory regular examinations of miners to discover those suffering from tuberculosis, as at first proposed. It is doubtful if the main features of the bill will be much altered.

Owing to the almost total failure of the rainy season in Rhodesia, a serious shortage of water is being experienced in many mining districts, and several batteries have already stopped work. The Lonely mine has cut the reef at the eighth level, 800 ft. vertical, assaying about 1 oz. gold over 4 feet.

The Hay mine is giving disappointing returns, but rich ore is being encountered in the third level of the large Shamva mine. The lode in the ninth or bottom level of the Eldorado mine has been cut, showing high-grade ore. The shares recently fell heavily on the report that the rich oreshoot was narrowing in depth. The consulting engineer states, however, that developments and prospects are satisfactory. The Cam & Motor mine will soon have 1,000,000 tons of ore developed, worth about 45s. per ton. An experimental roasting and cyanide plant, on West Australian lines, is now at work treating 300 tons per month with satisfactory results.

The Consolidated Gold Fields is floating the Golden Koppie mine, near Eldorado. The orebodies consist of irregular lenses of schist, highly mineralized, lying on the foot wall of banded limestone between granite and limestone areas. The lenses are from 6 to 32 ft. in width and the gold-bearing zone extends for five miles; only about 4500 ft. have been developed to date. About 176,000 tons have been fully developed, valued at 33s. 6d. per ton. It is proposed to treat 10,000 tons per month at a cost of 18s. 6d. per ton.

The Mining News

The Current History of Mining

Alaska

Cordova District

The increased price of copper metal has greatly stimulated copper mining in this section of Alaska. Properties that had been lying idle have resumed active prospecting in many instances, and producing mines have increased their shipments to the Tacoma smeltery.

Bonanza—The mine is now shipping 50 tons per day, but has been shipping 100 tons most of the winter. It is stated that the concentrator will be ready to begin operations June 1, after which time it is expected shipments will reach 150 tons per day, including the concentrates and the high-grade copper glance now being sent to the smeltery.

Alaska Consolidated Copper Co.—Alfred B. Iles, manager, was in Cordova recently, *en route* to the property, near McCarty station, on the railroad. New York and Pennsylvania men own the mine. Mr. Iles said that he would immediately arrange to ship the high-grade ore by pack train to the railroad, 18 miles, and hoped to ship a car per day. An air compressor and power plant may be installed this summer.

Northern Development Co.—A leaching plant will be installed on the property, at Copper Mountain. E. R. Gray is manager.

Regal Mines Co.—This mine, operated by the Northern Development Co., E. R. Gray, manager, is situated across the glacier from the Bonanza. Prospecting is being done on high-grade ore, and if depth is attained, motor trucks may be installed to transport the ore across the glacier to a shipping point.

Ellamar District

Three-Man Mining Co.—This company, at Landlocked Bay, will probably start regular shipments soon to the Tacoma smeltery.

Cliff—This mine recently changed owners.

Ellamar—A small compressor has been ordered to operate an air-lift to pump seepage water from the coffer-dam. It will also drive a small dynamo for lighting purposes.

Port Wells District

There is some activity in this district. Several prospects continued development during the winter, and good specimens, showing free gold, were brought out.

Arizona

Gila County

Inspiration Consolidated—Over 400 men are employed and the force is being increased. Three development shafts are being sunk and ore from development is being hoisted through another. Grading is being done on the site of the two concrete, three-compartment working shafts, which will be sunk 50 ft. apart and near the Inspiration camp. Ore from the Live Oak mine will be conveyed by underground haulage through the Keystone mine and hoisted through one of these shafts. Grading has not started yet for the 7500-ton concentrator. Preliminary surveys for the railroad to the mine and to the concentrator have been finished and the dam across Pinal Creek will be finished soon. The engineering force contains 24 engineers and their assistants, of whom 14 are employed on construction and 10 in the mine, besides the engineers at the Live Oak mine. W. C. Browning, formerly chief engineer at the Inspiration mine, has been made assistant superintendent of that mine, and E. G. Deane is now chief engineer. The firm of Repath & McGregor, consulting construction engineers, has charge of all construction work. Associated with it are F. J. Brule, H. J. Wallace and W. C. Holman at the head of a corps of 14 engineers.

Miami—Diamond-drill hole No. 1 is 125 ft. below the 570-ft. level, and has shown commercial ore for the entire distance, which may be taken as a favorable indication that the ore deposit extends to a greater depth than was estimated, all previous estimates having allowed only 50 ft. of ore below this level. The tailing elevator is finished and working satisfactorily. All tailing is now elevated 60 ft. and conveyed by a launder to the gulch east of the mill, where it is impounded. One churn-drill is exploring the northeastern part of the property.

Barney—Churn-drill hole No. 3 is 675 ft. deep and in silicified schist, after passing through conglomerate and dacite.

Southwestern Miami—Three churn drills are in operation, but drilling has been proceeding slowly, on account of caving. Ore is not expected for some time in any of the holes.

Arizona Commercial—The Copper Hill shaft has been retimbered to the fourth level, and a drift is being run on that level to connect with a drift from the Gray shaft of the United Globe mine of the Old Dominion.

Superior & Boston—The southeast crosscut on the 12th level is reported to be breasted in favorable looking ground, carrying considerable quartz and limonite. Ore is being shipped from the stope below the sixth level, 20 cars having been shipped in May. About 50 men are employed.

South Live Oak—Churn-drill hole No. 1 is 640 ft. in granite, carrying a considerable amount of the carbonates of copper. Carbonates were first encountered at a depth of 435 ft. and at 455 ft. chalcocite was encountered and the samples have since shown varying amounts of carbonates and chalcocite.

Copper Reef—The face of the main crosscut tunnel is being advanced and is now in over 1000 ft. The drift from this tunnel on the California vein is in 60 ft. from the tunnel and breasted for its full width in vein material, consisting of red hematite and clay gouge. Charles Saxman is superintendent and 11 men are now employed.

California

Amador County

Central Eureka—It is reported that most of the indebtedness has been paid and that a new compressor will be installed.

South Amador—A cave was encountered in the 500-ft. level which is being unwatered. When the mine is thoroughly drained, extensive prospecting will follow.

Lincoln—Driving the 2000-ft. level toward the Wildman is in progress. The large vein in the Wildman is said to be 160 ft. wide and in the earlier days the ore averaged $4 per ton on the 1400-ft. level. W. J. McGee, Sutter Creek, is manager.

Zeile—Fred O. Zeile and other directors recently visited Jackson, to consider future action regarding operations. An examination was made in February for possible purchasers.

Keystone—The mine has been unwatered to the 1400-ft. level, the lowest working. The shaft will be deepened 500 or 600 ft. C. R. Downs, Sutter Creek, is manager.

Calaveras County

Mother Lode-Mizpah Gold Mining Co.—This is a new company organized to operate mining properties near Moke-

lumne Hill. The capital stock is $1,000,000. The directors are P. B. Whitfield of Mokelumne Hill, E. Owen McCann and George C. Schoen, of San Francisco.

Penn—The copper smeltery at Campo Seco is treating about 150 tons of ore per day. The main shaft is down 1520 ft. A. P. Busey Jr., is manager.

ELDORADO COUNTY

Sherman—It is reported that this mine will close down as the ore in sight has been exhausted. It will be necessary to sink a new shaft and either move the mill or build a new one.

Melton—This mine at Poverty Point, recently purchased by A. Baring-Gould and associates, has been reopened. The mill has been enlarged and the property is now in operation. The first car of concentrates was shipped in May.

INYO COUNTY

Independent Lead-Silver Mining Co.—This company will start systematic development of the Santa Rosa mine recently acquired. Mr. Zabriskie, of New York, and B. F. Edwards, of San Francisco, both of the West End company, of Tonopah, are interested. S. H. Brady, general manager of the West End and Halifax companies, of Tonopah, is general manager. It is the intention to install 5-ton Pierce-Arrow auto trucks for transporting ore and supplies between Keeler and the mine. H. J. Meisel, formerly field engineer for the West End company, is superintendent.

Tiptop—About 15 cars of sorted ore await shipment. One team is employed, though an effort is being made to obtain more. The installation of motor trucks is contemplated. Chafey, Thorndike and McMillan, of Bishop, are owners.

Skidoo—During April, 1068 tons of ore were crushed. Only 10 stamps were in operation, on account of water shortage. Total yield was $12,508; development, $1468; operation, $7525 and $3515 profit.

KERN COUNTY

In the vicinity of Isabella, the following mines are operating on a small scale: Glen Olive, Early Sunrise, Keyes and Big Blue.

Mammoth—The force has been increased to operate the 10-stamp mill, two shifts on development ore. The main adit, now 1300 ft. long, is being pushed southward and raising is in progress in two places. Sinking will soon be in progress on the main orebody, already exposed 100 ft. above and below the adit. Leyner drills are used throughout. The ore is free milling and extraction averages 95%. A. G. Keating is in charge.

King Solomon—Operations are being resumed at this mine, three miles from Havilah. There is a 5-stamp mill on the property. The mine has eight main workings. A contract has been let to supply timber for fuel and mine purposes.

MARIPOSA COUNTY

Original—A mill is being installed at this mine, near El Portal. John E. McLean, of Mt. Bullion, is manager.

MODOC COUNTY

Two hundred men, representing about one-third of the miners, prospectors and others in the Highgrade district, at a meeting in Fort Bidwell recently considered proposed changes in location and assessment rules. An effort was made to extend the time for staking claims from 60 days to 90 days on account of the snow delaying the work, but the majority objected. Twenty days are allowed for setting stakes, and the balance of the preliminary work must be done within the 60 days. The report of Norman C. Stines was adopted as a fair and accurate estimate of the district.

NEVADA COUNTY

Champion—A good vein carrying a pay shoot is reported to have been disclosed in the Merrifield shaft. The unwatering of the 2400-ft. Champion shaft is nearing completion.

Delhi—The line of the proposed new 5½-mile flume is being brushed out. The sawmill for getting out the flume lumber is about completed. Hamilton Eddy is mine superintendent.

PLACER COUNTY

Trinidad—This mine in Sailor Cañon is reported sold to San Francisco men. There is a 10-stamp mill on the property.

Moss—Mr. Jeffry, of Oakland, is cleaning out and retimbering the shaft of this mine at Forest Hill, preparatory to developing the vein. He has installed a gasoline hoist and pump.

PLUMAS COUNTY

Long Bar—The mineral character of this claim is being contested by Susan Belden who sold the claim to Dr. P. F. Bullard. Mrs. Belden has since made a homestead entry which covers a part of the mining claim. The land is at Belden station on the Western Pacific Railroad.

TRINITY COUNTY

Trinity Consolidated Hydraulic Mining Co.—The three placer mines operated by this company, near Weaverville, are running with a full head of water for the first time this year. The season has been the driest in 30 years. The Union Hill placer, operated with 3000 miners' inches of water under a 460-ft. head, is moving 6000 cu.yd. of gravel per day, and the Hupp and Brown placers about 1500 yd. per day each.

Trinity Exploration Co.—This company was organized to acquire 700 acres of gold-bearing river channel, at Carrville, and to test it for dredging. To date it has drilled, with Keystone drills, 280 acres of the ground at a cost of $15,000, with such satisfactory results that this much of the 700-acre tract has been purchased outright and the options on the balance extended for such time as is necessary to complete the examination.

TUOLUMNE COUNTY

Black Oak—The new mill, now in operation, has been pronounced a success. All sliming, cyanidation and vacuum filtration are used.

App—The 20-stamp mill is operating on low-grade ore. The mine is said to be in poor physical condition, due to the cave-in last year. The United States Smelting, Refining & Mining Co. sampled the mine last winter, but the results are said to have been unsatisfactory. The Tonopah-Belmont Development Co. recently purchased the mine and a 100-stamp mill is contemplated, also an electric hoist and new headframe. W. A. Nevills is owner and manager.

SIERRA COUNTY

Telegraph—The electric equipment is being improved and a large amount of supplies has been hauled in preparatory to extensive development work this season. J. W. Finney is superintendent.

North Fork—A recent fire, caused by a short-circuit of electric wires, destroyed the hoisting works, with a loss of about $5000. They will be rebuilt immediately. George F. Stone is superintendent.

Willoughby—The mill above Downieville is being put in order for crushing the ore, which has been taken out since Jan. 1, 1912 by the owners, Dr. R. L. Jump, of Fruitvale, E. M. Farrell, of Downieville and their associates. E. M. Farrell is superintendent.

Tightner—Litigation recently brought to court has been settled by compromise for $14,000. H. L. Johnston retains title.

Colorado

CLEAR CREEK COUNTY

Richmond—This old producer of high-grade lead-zinc ore is being operated by Crandall & Hurley and is shipping ore to the Mineral Chief mill.

Morning Star—This property on Saxon Mountain, idle for 20 years, is being worked by Mottschall and Patton, who have from 2 to 3 ft. of high-grade zinc ore carrying 40 oz. silver per ton.

Bard Creek Mining Co.—This company owns a group of claims on Lincoln Mountain, and it is said that during the winter 200 tons of smelting ore were extracted in development on the Ohio vein.

Capital—The mill is making a satisfactory saving. About 60 oz. of amalgam worth about $4 per oz., and 20 to 30 tons of gold, silver and lead concentrates are obtained in one 12-hr. shift, the concentrates averaging about $40 per ton. The

production is reported to be close to $50,000 per month gross. A report is current that the property has been sold for $2,000,000 to an English syndicate.

Raymond Tunnel Co.—The Paris & Baltic group of 10 claims on Griffith Mountain has been taken over by this company and miners will be put to work soon developing the veins which were intersected by the crosscut tunnel, 850 ft. from the portal.

EAGLE COUNTY

At the head of East Lake Creek, a group of claims is being worked by A. Y. Stubbens, who is driving a crosscut tunnel to develop them and he has cut several veins. He intends to erect a mill to treat the low-grade ore at the dump.

FREMONT COUNTY

United States Reduction & Refining Co.—The Union plant at Florence is operating on the old chlorination dump. Leaching with cyanide is the process.

LAKE COUNTY-LEADVILLE

Yak Tunnel—The output for the month will be about 12,000 tons. The tunnel is in Vega territory. The lessees are doing well and are taking out a heavy tonnage of good ore.

Double Decker—This mine, under Manager Covey, is shipping a car per day of good-grade ore.

Nevada—A 5-ft. vein of ore has been opened that nets the lessees $30 per ton. It is lead ore with gold. Three cars per week are being shipped to the Arkansas Valley smeltery.

Kyle Mining Co.—The mill which was erected to work the gravel from the Kyle placer, near Soda Springs, is now treating 50 tons per day, under the superintendence of B. C. Nelson. The free gold and black sand are being saved by crushers, rolls and tables, and it is stated that the material runs $1 per cubic yard.

Waterloo—The shaft has been repaired and Mr. Cramer, superintendent, says about 50 tons per day are being hoisted.

Denver City—The shaft has been retimbered and at the 300 level prospecting is being done for carbonate of zinc ore.

Jolly & E. K.—The lessees have opened a body of good iron ore and want the Colorado & Southern R.R. to extend the old Bison spur to the Jolly shaft, so as to load the ore directly into the cars. The railroad officials are considering it.

MINERAL COUNTY

Creede-Triune—The foundation of the 300-hp. generating station is finished, and the cutting of the station has been completed on the 12th level of the Amethyst, preparatory to shipping.

Mollie S.—After several years idleness, the mine is resuming operations, under lease to R. S. Light.

Creede Mines Co.—This company has finished installing three Wilfley slime tables and has erected a large settling tank to separate sand and slimes in tailings, so that the slimes may be sluiced to the settling pond.

OURAY COUNTY

Indiana—This mine, owned by the Brown Mountain Smelting Co. and situated near Ironton, has 2½ ft. of good-grade copper ore. Three large snow slides, that ran across the road have to be cleared before ore hauling will be possible. The pyritic smeltery will start about July 1. M. C. Canfield is superintendent.

Barstow—This gold mine near Ironton has its stopes and bins full of ore.

ROUTT COUNTY

The Yarmony district has been prospected for 15 years but only recently has any ore been developed. Copper is the chief mineral sought. It occurs in sandstone forming a contact between Cambrian limestone and quartzite. In 1911 this deposit was opened by a 385-ft. incline and 150 ft. of crosscuts. The oreshoot was found to be about 50 ft. wide, with good ore in the breast of the tunnel. The ore is a carbonate and oxide, with a little native copper, and averages about 5% copper. A Leadville man is planning the erection of a mill in the district, of which McCoy is the center.

SAGUACHE COUNTY

Rawley Mining Co.—This company, operating at Bonanza, ended its first year's work on its 6250-ft. drainage and development tunnel, May 11, having advanced 4025 ft. during that period. The bore is 7x8 ft. in the clear. The record month was March, 1912, when the heading was advanced 470 ft. with two shifts of machine men and three shifts of muckers. In April, water retarded progress for several weeks. The tunnel is now in good ground again. The plant is equipped with Leyner drills and other modern machinery. A. C. Russell is manager.

SAN MIGUEL COUNTY

Junta—The 110-ton San Miguel mill under lease to this company, was recently destroyed by fire.

Smuggler—The stamp mill is being remodeled by G. Caetani; the Gilpin bumping tables are being replaced with Wilfley tables and Hardinge mills are being used. The cyanide plant is being reconstructed under the direction of Supt. Walter L. Reid.

Tomboy—The mill has been overhauled, and Hardinge mills installed for re-treating middlings. Wilfley tables are used. G. Caetani had charge of this reconstruction.

TELLER COUNTY—CRIPPLE CREEK

It is stated that 10 electric hoists have been installed in the district within the last two months and that more are projected.

Ajax—The Colburn-Clancy mill is to be closed for alterations and improvements and the sampling plant is to be enlarged. This will take about 30 days and the time of the lessees will be extended for that period.

Isabella—It is estimated that the May output will be 55 cars, the royalties from which will be about $4000. About 30 sets of leasers and 15 machine drills are at work.

Last Dollar—The output for May will be about 400 tons of mill ore. Six cars shipped to the Portland mill, at Colorado City, ranged from $20 to $40 per ton.

Stratton's Independence—During April, production totaled 3004 tons of ore, averaging $16.12 per ton. Low-grade mine and dump ore, amounting to 10,600 tons, was milled. Net working profit at mine and mill was $16,000, and $2000 were spent on special development.

Idaho

Idaho Tungsten Co.—The company's mine at Patterson, Lemhi County, is developed by tunnels. The 500-ft. tunnel is being worked and good ore has been opened, 2 to 10 ft. wide. The upper tunnel is 900 ft. long, and is reported to show ore almost the entire distance. Several other tunnels from 20 to 150 ft. long, show ore. A 100-ton mill is under construction. A 2x3-ft. flume will furnish power. G. W. Kessler, Patterson, is superintendent.

Illinois

Press dispatches recently reported that a well, drilled by the city of Joliet, to increase its water supply, had turned out to be an oil well when the pumps were applied. The facts are as follows: The well is within 200 ft. of an old gas works. Apparently refuse gas-house products were encountered in the limestone at 225 ft. After casing to 300 ft., drilling was continued to 1571 ft. After passing through the Potsdam sandstone, the pumps were put on. Immediately oil, gas and a tarry substance were obtained in sufficient quantity to pollute the water for domestic purposes. This continued for a month. After extending the casing to 900 ft., the trouble was lessened. Analyses are being made to determine the origin of the oil and gas.

Michigan

COPPER

Osceola Consolidated—No. 6 shaft at the old Osceola branch, resumed work with about 50 men, on June 3, after a shutdown since April, 1910. The Consolidated expects to spend about $150,000 during 1912 for new construction at the mines and mills.

Franklin—At present about 325 men are employed, and this number is being increased. It is said that in April, for the first time in many months, copper was produced at a profit.

Isle Royale—It is reported that a new shaft, No. 7, will be sunk at a point south of No. 6, now the most southerly shaft. Good ground has been opened in the southerly workings from No. 6 shaft. Judge Sessions, at Marquette, June 3, denied G. H. Hyam's petitions, to restrain this company and the Tamarack from entering upon the mill plans proposed by the Calumet & Hecla company. These plans will be carried out.

IRON

Lucky Star—An Ingersoll-Rand, 800-cu.ft. compressor has been installed at this new Breitung-Kaufman mine, at Negaunee. About 15 ft. of quicksand were recently encountered in sinking the shaft.

Breitung Hematite—A steam shovel is shipping from the high-grade stockpile.

Lucy—This Cleveland-Cliffs mine, at Negaunee, is shipping ore from stockpile, but the underground workings are idle.

Youngs—This mine, of the Huron Mining Co., at Iron River, has shipped no ore so far this season, although a heavy shipper in previous seasons.

Caspian—This large mine, of Pickands, Mather & Co., at Iron River, has been shipping about 1200 tons of ore per day from the pocket and 2000 tons from the stockpile.

Bengal—At this new Pickands-Mather mine, at Stambaugh, the shaft has been completed to bedrock at a depth of 140 ft., by William Harris, of Gwinn. The shaft was started a year ago and was almost abandoned several times, on account of quicksand and water. At the Barras shaft, no ore has been shipped, on account of lack of transportation facilities. Tracks will soon be extended to the shaft and meanwhile adequate machinery will be installed.

Minnesota

Wisconsin Steel Co.—This company's new washer at Nashwauk started operations recently. The plant has an annual capacity of 500,000 tons per year. It is operating on ore from the Hawkins mine.

Montana

BUTTE DISTRICT

Davis-Daly—On the 1900-ft. level of the Colorado mine, a strike of rich ore was made, May 24. The vein where first encountered was 2 ft. wide, but it has widened to 6 ft. Underground conditions have been gradually improving in the last few months.

East Butte—Robert H. Gross, president, recently made an inspection of the property. He is pleased with conditions. During April, 1,300,000 lb. of copper were produced, the ore averaging 6.13% copper, most of it mined from the 800-ft. level. This is the largest month's output of the company to date. The 1000-ft. level is being opened and the ore so far uncovered exceeds in grade any of the ore in the levels above.

Butte & Superior—The mine has been closed down for extensive improvements, and probably will not be running again for over a month, except for development and repair. A new hoisting plant, capable of hoisting from a depth of 3500 ft., a new steel gallows-frame, and 5-ton skips, will be the main features of the new equipment. The new mill will, in the meantime, be operated continuously, as ore has been provided to be used during the shutdown. The mill is working successfully, and it is expected that it will soon be treating 500 tons of ore per day.

LINCOLN COUNTY

Hazel T.—A shoot of ore was recently encountered at this mine, near Libby, containing good gold, silver and lead ore. George H. Chandler is president.

MADISON COUNTY

With the opening of the roads into the Silver Star district, general activity is again being shown there and the prospects are for a good season.

Hudson—At this mine, owned by the Largey estate, of Butte, 10 men are at work, and the mill is being operated continuously.

SANDERS COUNTY

Montana Gold Mines—Preparations are being made to resume development at this property, and miners have been hired in Spokane by Frank McCaffrey, manager. Considerable development has already been done. The ore contains free-milling gold, and a quantity of ore is said to be blocked out.

Nevada

CLARK COUNTY

The region in the vicinity of Nelson consists of dikes and veins, the latter carrying from $6 to $20 per ton in gold and silver, over widths of from 4 to 25 ft., and opened to depths up to 500 ft. Development is retarded by large ownerships vested in few men, who prefer not to exploit the district at present.

ELKO COUNTY

Idaho men are planning to bring electric power into the Gold Circle camp. One mill is now in operation in the district.

Success—This and the Rock Creek claims, recently under option to George Wingfield, have been incorporated and further development will be done.

Bluster—Good milling ore has been opened on the footwall of the main vein.

Alpha—This group under option to Chicago men, is being developed rapidly. A trail is being built to take in a hoist. The 75-ft. shaft will be sunk to 200 feet.

Esmeralda—This group in the Gold Circle camp has been sold by McMahon & McCauley for $45,000 to George H. Davis. The mine is stated to be a large, low-grade property. A mill may be erected.

ESMERALDA COUNTY

Goldfield Consolidated—The estimated May production was 30,209 tons; gross value about $500,000; net, $300,000 and $200,000 operating expenses for the month.

NYE COUNTY

Shipments in tons from Tonopah mines to date and for the week ended May 23, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,450	68,969
Tonopah Belmont	1,550	42,976
Montana-Tonopah	1,084	21,346
Tonopah Extension	1,035	20,102
West End	750	14,934
Midway	.....	180
MacNamara	450	7,270
North Star	.....	80
Totals	8,319	175,857
Estimated value	$208,925	.....

New Jersey

New Jersey Zinc Co.—For over a year past, a diamond drill has been at work on the old Marshall mine, at Ogdensburg, three miles from Franklin Furnace, in Sussex County. This mine was at one time a large producer of zinc ore, but has not been worked for 17 years. The company has now put a force of men at work, repairing the old headframes and machinery and cleaning up generally. It is reported that a new shaft is to be sunk.

New Mexico

SIERRA COUNTY

Hopper-Bigelow—This company, of 100 Broadway, New York, controls the following companies in this county: Victoria Chief Copper Mining & Smelting Co., Wellington Copper Mining Co., Statehood Mines Co., Vanadium Queen Mining Co., and the Cutter Townsite Co. Of these the Victoria Chief and Statehood are the most important. The former was equipped with a good camp, general store, fine engines, expensive machinery, etc., but profitable ore was not found. These two companies have now gone into the hands of receivers.

SOCORRO COUNTY

Deep Down—The leasers are sinking the winze and have been shipping 15 tons of ore per day to the Deadwood mill, taken out in development.

Treasure—The old ore bins were destroyed by fire on May 25, and the mine crew was put to grading for new ones, which will be in commission soon. A good ore reserve at the mill will likely prevent any shutdown before the ore teams are again at work.

Ernestine—The two cleanups for the first 20 days of May yielded 21,725 oz. of gold

and silver bullion, and 22,550 lb. of high-grade concentrates. This is the best 20-day record of the company thus far. The last week's ore treatment was 698 tons.

Oaks—The Pacific and Johnson mines shipped 30 tons to the Deadwood mill from 21 ft. of development.

Oklahoma

The Emma Gordon and Turkey Fat mills are the only ones operating steadily. Most of the other mines are sinking to the lower orebody. The 30-acre, Miami Royalty Co. and Chapman & Lennan are erecting five new mills. Shafts are being sunk by the Carson-Dodson, Donna, Prairie, and George Moore & Co., and mills will be erected on these leases soon. Many drills are at work in the district. There are about 20 mills at present and about 10 more are either under construction or contemplated.

Chapman & Lennan—At the Emma Gordon lease a 3000-gal., triple expansion, condensing Prescott steam pump is being installed at the 275-ft. level. This is expected to lower the water level of the entire camp to 300 feet.

Oregon

Lane County

Vesuvius—F. J. Hard, manager of this mine at Bohemia, reports a fire, which destroyed the tunnel houses and other buildings, with a loss of over $2000. Work will be delayed some on account of the fire. The property is owned by Boston men.

West Coast—The electric power plant at this mine is said to be running satisfactorily. Superintendent Hogue is at the mine after a short trip. Several bricks have been shipped recently and the company is a steady producer.

Lincoln County

Platinum & Gold Extraction Co.—This company has been incorporated, with principal offices at Newport, Ore. The purpose is to search for platinum-bearing placer ground in the county and state, also to develop beach placers near Newport. The incorporators are George L. Stoney, R. L. Warner and G. A. Hartley.

South Dakota

Black Hills District

Columbus Consolidated—During the last few days a number of the obligations have been paid, including $16,234.14 delinquent taxes, and judgments to Fred Rossiter for $10,032 and C. D. Taggart, $5018. The judgments run until Oct. 5, and unless they are redeemed before that time the property will pass into the hands of J. T. Milliken, president of the Golden Cycle Mining Co., of Colorado, who furnished the money to meet the three obligations. The property consists of about 600 acres, adjoining the Homestake on the north, and supposed to contain the extension of the Homestake vein system.

Golden Summit—Canfield and associates are operating the mill, at Hill City, on ore that is running $25 per ton, saved on the plates.

Utah

Salt Lake County

Utah Copper—The April production was 9,069,237 lb. copper, as compared to 8,160,300 for the month before. From 18,000 tons to as high as 24,000 tons of ore are reported to have been handled in one day.

Montana-Bingham—Copper ore, largely of milling grade but carrying portions as high as 8%, has been cut by this company's tunnel from McGuire's gulch. This tunnel is being driven to develop this company's ground, and to reach the Bingham Amalgamated, Fortuna, Copper Glance, Congor, Starless and other properties at depth. This will enable these properties to send out their ore to the Copper Belt Ry., as the transportation facilities are poor on the east slope of the range.

Ohio Copper—No report as to mine conditions or operations has been published for two years, and it is hoped that something definite will be given out at the annual meeting in Portland, on June 5. The mill is said to be doing fair work, and is handling about 2000 tons per day.

Bingham Mines—A report, showing the financial condition of this company, has been made, according to the Massachusetts law. According to the report, the value of real estate and mines, construction, equipment, cash receivable, mining stocks, sinking fund, etc., is placed at $2,122,296, for 1911. The liabilities, capital stock, accounts payable, floating and funded indebtedness, together with accrued interest, etc., are placed at a like amount.

Utah Metal—There still remains 2200 ft. to be driven of the 11,000-ft. development and transportation tunnel between Bingham and Tooele slope.

Bingham Copper—The stockholders' protective committee has received over 465,000 shares of the 750,000 outstanding, these being relative to the proposed reorganization. The recent assessment will be used to pay off the company's indebtedness, and to put things in better shape generally. The claims cover 125 acres adjoining the Utah Apex and Utah Consolidated.

Columbus Extension—Drifting east from the tunnel level has been discontinued, and work to the west is underway to reach the contact between the white and blue limestone.

Michigan-Utah—Shipments have been started on several hundred tons of ore, which have accumulated during the winter.

Summit County

Thompson-Quincy—The new raise, being driven through the quartzite toward the overlying limestone, is nearing the contact.

Silver King Coalition—The electric traction line through the Alliance tunnel has been completed and will facilitate an increased output. The Silver King ore zone has been opened at several new points. About 300 men are on the payroll and the output varies from 500 to 800 tons per week.

Daly West—Milling is expected to be resumed within the next two weeks, as the water supply in the Bonanza Flat lakes is increasing. About 35 men will be added to the present force. The present output is about 500 tons per week.

Wisconsin

Grant County—The Cudahy interests of Milwaukee and Chicago have subleased this mine and have commenced underground work; the property lies between the Empire and Old Homestead mines.

Wisconsin Zinc Co.—The Wisconsin Zinc Co. has shown a continuation of the Klar-Piquette range on the Seitz land, held under 60-day option for $75,000.

Kruse—A local company has started prospecting on this land just west of the Klar-Piquette.

Mound City Mining Co.—The company has begun drilling on the old Hodge property within the city limits.

New Enterprise—This company has developed a good body of zinc ore in the old Enterprise, the pioneer zinc mine of Platteville, which has lain idle for three years.

Beloit-Elmo—Mining operations have been resumed again with crude oil engines to generate power.

Vinegar Hill Zinc Co.—The company is constructing a small test mill on the Gritty Six-Raisbeck tract.

Wyoming

At the second annual convention of the Wyoming oil men's association, held at Caspar, a resolution was passed favoring the examination of persons or companies desiring to do business, as to their resources, etc., and the issuance of a certificate to legitimate concerns, this being done in order to prevent wildcatting.

Victoria Gold Co.—It is reported here that free-gold ore has been found in this company's mine on Middle Fork, near Centennial. Free gold is found in pockets and some of the ore showing no free gold assayed high. A. F. Lindsley of Centennial is president and general manager.

Canada

British Columbia

Reports have been circulating in New York during the last week that the smelting works at Trail, B. C., had been closed. We have been officially informed that there is no truth whatever in those reports.

Hastings Exploration Syndicate—The company at Nelson closed down operations at the Arlington mine on May 1, and has given a lease to W. J. Barker, late foreman, to clean up the remaining ore. Leslie Hill is consulting engineer.

Blue Bell—This mine at Riondel, S. S. Fowler, manager, is installing a 40-drill compressor, driven by a 9-ft. impulse wheel. The order was filled by the Nelson Iron Works.

Granite-Poorman—Good ore has been found on the Hardscrabble vein, with development well ahead of requirements. The company will soon resume experiments on the treatment and recovery of iridium and other metals of the platinum group, which occur in a 12-ft. peridotite dike.

Ontario

Elizabeth—At this gold mine, in the Atikokan district, a 10-stamp mill will soon be ready for operation. Five stamps have been installed and 20,000 tons of ore are blocked out.

McKinnon—These claims, near Dane, were worked for some time by a Montreal syndicate. Two shafts have been sunk in ore, one of which is down 150 ft., one of the walls being solid chalcopyrite with some bornite assaying high in copper. Several cars of ore are on the dump. G. McMurty has come from Arizona to take charge of operations.

Cordova Mines, Ltd.—No. 1 shaft is being enlarged and retimbered, and a double-drum, 10x12-in. geared hoist is being installed. No. 3 shaft is being cleaned out, preparatory to sinking 40 ft. to the 500-ft. level. At the power plant, a 250-kw., 3-phase, 60-cycle generator, initial voltage 2200, is being installed and direct connected to a turbine. This is an auxiliary to the 5000-ft. Walker, rope-driven compressor, run by an 800-hp. Leffel turbine, which is at present supplying power to the mines and mill, 2½ miles distant, air being carried through a 12-in. pipeline. The 30-stamp mill is being supplied by No. 3 mine and is showing increased extraction since the introduction of 45-mesh, slotted screens, and raising of the discharge 7 in. Extraction by amalgamation is averaging over 76%. The concentrates are cyanided with fair returns, which are expected to be increased by the installation of regrinding machinery. A large, central shaft is contemplated, through which all ore will be hoisted. Charles Mentzel, Cordova Mines, is manager.

Ontario—Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended May 31, and for the year to date, are:

La Rose	179.95	1,459.26
Coniagas	41.70	813.50
O'Brien	.....	263.24
Right of Way	.....	148.60
Chambers-Ferland	.....	193.60
McKinley-Darragh	119.73	1,140.36
Nipissing	32.57	825.18
Hudson Bay	.....	312.62
Buffalo	30.15	442.72
Crown Reserve	.....	210.26
Cobalt Townsite	31.50	536.78
City of Cobalt	.....	145.84
Trethewey	33.18	207.39
Colonial	.....	41.60
Kerr Lake	.....	319.66
Cobalt Lake	31.15	207.41
Drummond	18.55	318.77
Temiskaming	63.27	383.91
Beaver	55.55	187.89
Wettlaufer	.....	111.21
Provincial	.....	22.22
Casey Cobalt	.....	24.50
Totals	637.33	8,185.52

Bullion shipments in ounces

Nipissing	104,112.03	1,587,763.75

Peterson Lake—The attempt to overturn the present directorate has failed. Operations during the last year were conducted at a loss. The company is now operating the Little Nipissing lease.

McKinley-Darragh—The management estimates that the production for the first six months of 1912 will amount to 1,500,000 oz., which is considerably in excess of the amount produced during the corresponding period last year. The increase is mainly due to two new swamp veins, on which work was begun in April. Both veins yield ore running approximately 4000 oz. per ton, and average 4 in. wide, carrying occasional rich pockets of argentite.

Nipissing—In a raise from the intermediate level on vein No. 122, ore has been encountered 60 ft. from the surface. A good tonnage of low-grade ore has been found in the east drift of No. 73 vein, on the third level.

La Rose—A party of directors made an inspection of the property, May 29.

Trethewey—Work has commenced on shaft No. 6, situated near the mill, and it will be put down 175 ft. At this depth it is intended to drift east and develop along the eastern line of the property, adjoining the Nipissing.

Cobalt Townsite—This company is negotiating for the control of the Cobalt Station Grounds property.

Nova Scotia—On May 20, this property, the liabilities of which amounted to $245,000, was sold for $82,000 to D. M. Steindler, of New York, a director of the company and one of its largest creditors.

W. S. M. K.—On this property, formerly the Green-Meehan, the vein encountered at the 200-ft. level as a mere stringer has been followed for 125 ft., and has widened to 9½ in. of high-grade ore, with wall rock for several feet on each side, furnishing good milling ore.

Ontario—Porcupine

Moneta—A thousand feet of diamond drilling will be done from the crosscut at the bottom of the shaft.

Porcupine Gold—The mill will start producing soon, as practically all the machinery is in place.

Hollinger—The management has decided to install 10 additional 1500-lb. stamps, bringing the total complement to 50. It will not be necessary to install additions to the crushing and cyanide plants, as these were originally designed for a capacity of 500 tons per day.

Dome—All the stamps are in steady operation, the only stoppage being to clean the plates, which puts five stamps out of action. A fourth shipment of gold will be made soon.

Pearl Lake—This company has been transferred to the control of a syndicate of New York and Philadelphia men, who have provided for the payment of its liabilities, amounting to about $100,000. Development will be resumed in charge of Col. R. W. Stephenson, under the direction of the Hargraves Engineering Co., of Philadelphia. M. J. Ramsay and J. E. Wright, of Philadelphia, have been elected directors.

Achilles—This property has been sold.

Success—This property may be reopened soon. More money is needed.

McEneany—This mine has shipped 30 tons of ore for treatment, to determine the kind of a mill for handling its ores. Arrangements have also been made to put 100 tons through the McIntyre mill.

McIntyre—A quartz vein, 27 ft. wide, has been cut on the 200-ft. level, near the center of the west end of Pearl Lake. The force has recently been reduced, owing to lack of air power.

Mexico

Chihuahua

It is reported that W. D. Ross, general manager of the Metropolitan Bank, of Toronto, Can., and a number of other wealthy men of that city, have formed a syndicate, capitalized at $10,000,000, which has taken over a number of mines in the Parral district, the total consideration being more than $1,000,000 gold. The mines embraced in the transaction are the San Patricio, Santa Ana y Anexas, La Revenda, Sierra Madre, Union and Trinidad.

Cuba

Dalquiri—Reports state that some damage was done to these mines of the Spanish-American Iron Co., during the recent revolutionary disorders.

Asia

Chosen

Oriental Consolidated—Cable advices state that $129,500 was the amount of the May cleanup.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, June 5—Coal trade in the West seems to be moving now with a fair degree of smoothness. Supplies at all the large consuming centers are large, and prices are rather weak. The Lake trade is not opening as briskly as had been expected. There are plenty of vessels to be had, but deliveries at the ports are rather slow, except in the case of West Virginia coal. Ohio coal is coming forward rather slowly.

The Seaboard bituminous trade is dull, although demand is pretty good for the season. The supplies hurried to tidewater in anticipation of a strike are still a load on the market and are being worked off very slowly.

Anthracite trade is slowly swinging back into its usual course and nearly all the collieries are making shipments. A tidewater schedule has at last been agreed upon, or at any rate adopted—the anthracite companies do not like to talk about agreements. The new schedule is $5 for broken, $5.25 for egg and stove, $5.50 for chestnut and $3.75 for pea, all f.o.b. New York harbor. From these prices a discount of 30c. per ton will be allowed for June.

United States Foreign Trade—Imports of coal and coke into the United States four months ended Apr. 30, long tons:

	1911	1912	Changes
Anthracite	.....	30	I. 30
Bituminous	521,341	488,591	D. 32,750
Coke	39,917	27,367	D. 12,550
Total	561,258	515,988	D. 45,270

Canada furnished this year 437,526 tons of coal and nearly all the coke; Australia, 43,630 tons of coal.

Exports of coal and coke from the United States, with coal furnished to steamships in foreign trade, four months ended Apr. 30, long tons:

	1911	1912	Changes
Anthracite	984,064	811,465	D. 172,599
Bituminous	3,044,786	3,561,816	I. 517,030
Coke	349,369	258,275	D. 91,094
Bunker coal	2,092,205	2,459,734	I. 367,529
Total	6,470,424	7,091,290	I. 620,866

The bunker or steamship coal is practically all bituminous. Canada took this year 2,676,466 tons of coal; Cuba and the West Indies, 638,580; Mexico, 112,657; Panama, 139,370 tons.

Iron Trade Review

New York, June 5—The iron and steel markets show practically little change from our last report. The mills generally are filled up, as specifications come in on a liberal scale. New business is not quite as active as it has been, except in a few lines; but the new orders are nearly, if not quite, sufficient to make up for shipments.

While the situation remains perfectly sound, it is no doubt true that the general tone of the market is less favorable than it has been. There is a lull which does not affect current operations, but which if continued will affect the future unfavorably. In some quarters the view is held that after the party conventions, and after the next crop reports are out, a fresh accretion of enthusiasm will come and the market will then brighten up all around.

The general advancing tendency in steel products is over for the present. In bars, plates and shapes, although the mills are very well sold up, there is no definite trend toward higher values. An illustration of this situation is that hoops remain at 1.25@1.30c., which has been the market for months, during which time merchant bars advanced from 1.05 or 1.10c. to 1.20c., while hoops have in the past always commanded more than merchant bars, frequently $4 a ton.

Pig iron is a little less active for foundry, but there is a strong demand for basic pig both in the East and in the Central West. Southern basic has been sold in considerable quantity, one large order going to St. Louis. There is a strong demand for low-grade iron from the pipe foundries, all of which seem to be very busy on contracts.

The Alabama Consolidated Coal & Iron Co. seems to be in trouble over its financing. It has been unable to place a new issue of bonds from which it was expected that the floating debt could be paid off. The Baltimore Trust Co. recently advertised a sale of $1,250,000 new bonds, which had been given as collateral for money borrowed and overdue. A temporary injunction, however, has been obtained against the sale.

Birmingham

June 3—Pig-iron manufacturers in Southern territory are not rushing last-quarter business, being confident there will be need for all the iron that can be produced for that period of the year. The books are nicely covered for the third quarter of the year and inquiries are in hand which will result in further business being procured before that time sets in. The iron quotations are firm with $11.25 per ton, No. 2 foundry, as the minimum, and $11.50 as a general quotation. The corporations are not quoting under $11.50 for the last quarter of the year, in fact, there is no inclination to dispose of iron under that price. The make in the South shows no improvement worthy of mention. The reduction of stocks continues and within a few weeks the statement can be made that there is less iron on furnace and warrant yards in this part of the country than has been seen in two years and more. The furnace companies are dealing carefully with future business so far as the lower grades of iron are concerned, the sales so far made in that line being such as to warrant care. Cast-iron pipe makers have been healthy purchasers of pig iron so far this year and are in the market again for a good quantity, the pipe makers having very bright prospects.

The machine shops and foundries are using a little more iron and efforts are being made to secure business to keep them well supplied through the summer at least.

Reports are satisfactory, considering, as to steel in Southern territory. Some small orders for rails were recently received by the Tennessee Co. and business for other steel shapes is being worked out. The demand for basic iron is steady.

Baltimore

June 3—Exports for the week included 2,690,450 lb. steel billets, 178,885 lb. tinplates, 22,400 lb. rails, 23,680 lb. frogs and 903,780 lb. sheet bars to Liverpool; 336,700 lb. iron pipe to Antwerp. Imports included 50 tons silicospiegel from England; 10,424 tons pyrites from Huelva, Spain; 12,850 tons iron ore from Cuba.

Chicago

June 4—The demand for pig iron continues small, but prices are firm and conditions warrant the belief that there will be a steady sale in small lots of a large aggregate of iron for the next week or two. A few inquiries are out for lots of as much as 1500 tons, but melters in general seek lower prices than the furnace representatives will make, on last-half deliveries. Sales in general run from a carload to 300 or 400 tons. Northern No. 2 brings $14.50@15 at furnace, and Southern No. 2 brings $11@11.50, Birmingham, or $15.35@15.85, Chicago. Lake Superior charcoal holds to $15.75@16.25, and is in light demand.

Activity continues in the market for iron and steel products of almost every sort. Railroad supplies are in good demand, from standard rails down to spikes and bolts, at unchanged prices. Structural material continues in demand for work throughout Western territory and much more work appears in sight; prices are constant at 1.43c. for beams and channels of 15 in. or smaller. Bars are in very good condition for the selling interests, and producers are pushed to make deliveries even reasonably behind scheduled dates. Iron bars bring 1.25@1.30c. and soft-steel bars 1.38@1.43c. base, the lower prices being the rule. Plates and sheets are in very good demand, at unchanged prices. Billets have a fair sale at $28, for openhearth forging, the local demand being normally light. General trade conditions continue good.

Cleveland

June 3—Iron ore is coming down freely now. Sales are apparently over for the season.

Pig Iron—Numerous sales of moderate size have made up a heavy total of new business. Prices are a shade higher. Quotations, Cleveland delivery, are $15.15 for bessemer, $13.50 for No. 2 foundry, $13 for forge and $15.75 for Lake Superior charcoal.

Finished Material—New business is moderate only, but specifications are heavy, and some mills are behind in deliveries. Plates and structural steel are in especial demand.

Philadelphia

June 5—The anticipated general buying movement in pig iron has not yet set in; most furnaces are sold ahead but there is no disposition shown by makers to yield a point. A good many inquiries are on the market from the larger buyers for delivery later in the year. Southern furnaces are selling freely and are naming higher quotations for the last quarter. The pipe interests have made extensive purchases, some for third and some for fourth quarter. Much comment is made on the possibility within 30 or 60 days of a shortage of steel-making irons and there are some surface reasons to apprehend it. Foundry iron is more actively inquired for and basic still more so. There is a greater probability of an advance in pig probably late in this month or early in July. Consumers, large and small, are showing a willingness to accumulate stocks where they find it possible to do so at something less than current asking prices.

Billets—Production of billets is on the increase and maximum capacity will be demanded. Forging billets are particularly active.

Bars—Bars continue to move freely and recent inquiries indicate a still larger movement.

Pipes and Tubes—The activity in pipe is quite marked over two weeks ago. The tone of the market is strong and work for 30 to 60 days delivery is more abundant than for months. Tubes continue to move freely at the advance.

Plates—Premiums have been paid on several lots of plates for prompt delivery and there is more business of this sort pending today. A great many inquiries are in the market for plates, mainly from car builders.

Structural Material—Some business has been delayed in view of the possibility of lower prices that were expected to develop during June. The situation today indicates strong prices for shapes throughout the summer except in two or three instances where negotiations have been hanging fire for two or three weeks for New York and eastern delivery. Minor building orders are quite numerous.

Scrap—The heavy recent purchases of scrap have covered urgent requirements but a fair business is still being done.

Pittsburgh

June 4—New business in iron and steel products has grown still lighter, and the market is relatively quiet in this respect. In specifications against old contracts, however, the activity continues at almost as high a rate as formerly and at a rate in excess of current shipments. The majority of buyers are contracted through the third quarter, some of them through fourth-quarter also, and great activity in new buying is not essential to the continued operation of the mills over the next few months at the current rate.

Under date of June 1 the National Tube Co. advanced merchant steel pipe and oil country goods one point, or about $1.90 per ton, on all sizes 6-in. and less, making the regular discount on jobbers' carloads of merchant pipe, card weight, ¾ to 1½ in. inclusive, 80% off list instead of 81%. Merchant weight is one point greater discount, or one point lower price, while there is a regular discount to large jobbers beyond the regular card rate. The advance was promptly concurred in by the independents, although the fact is that for the past six weeks the regular market has been shaded in the case of attractive business, the cuts being only fractions of a point, and each order being quoted against separately. The mills have thus accumulated a good lot of specifications. Existing contracts at the old prices run through this month, and good specifications are to be expected against them, as a result of which July 1 will likely find the pipe mills provided with specifications for say 60 days' run, and they will then be in position to quote the advanced prices on new business.

Pig Iron—There is considerable brokerage inquiry for basic pig iron and the market may perhaps be on the verge of a decided change. As to actual transactions there is nothing new. The basic average for May, compiled by a trade authority from actual sales of lots 1000 tons and over, is announced at $13, Valley, or $13.90, Pittsburgh, and this average confirms the view taken in these reports that rumors of sales of basic above $13 Valley in the past month have not represented actual transactions. The bessemer average, similarly compiled, is announced at $14.2345, Valley, or $15.1345, Pittsburgh. Foundry iron continues quiet. The merchant furnaces now in operation are well sold up, and it would require very little buying to advance the market. We quote: Bessemer, $14.25; basic, $13@13.25; malleable and forge, $13; No. 2 foundry, $13.25, all f.o.. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—High prices continue to be paid for small lots, up to $55@57 for carloads, Baltimore, while the regular contract market, which is more or less nominal, remains at $48.50, Baltimore.

Steel—The shortage of billets and sheet bars is still more pronounced, and fancy prices have to be paid for prompt steel, up to $22 or higher, while $23 has been paid for small billets. The regular market prices for extended delivery, upon which term contracts are based, are approximately as follows, f.o.b. maker's mill, Pittsburgh: Billets, $20.50@21; sheet bars, $21@21.50; prices f.o.b. maker's mill, Youngstown, being about 50c. less. Wire rods are $24.50@25, Pittsburgh, having grown weaker in the past fortnight.

Sheets—Specifications continue good, and the mills are operating at a slightly better rate, with specifications coming in just about fast enough to maintain as much business ahead as formerly. Prices are unchanged, the higher figures representing the minimum of the American Sheet & Tin Plate Co.: Black sheets, 1.90@1.95c.; galvanized, 2.95@3c.; blue annealed, 1.40c. for 10 gage.

St. Louis

June 3—The pig-iron market remains about the same. The demand is fairly active with the market mostly in the hands of the sellers. Producers are all sold up for the next two months. While the market has a strengthening tendency there will probably be no further advance in prices for the summer months, as the usual summer lull will undoubtedly offset the strengthening market for the time being. No. 2 foundry is still being quoted at $11@11.50 per ton Birmingham or $14.75@15.25 per ton St. Louis, Northern No. 2 iron is quoted around $15, St. Louis.

Coke is a little bit easier and is being quoted at $5 per ton St. Louis for good foundry.

Iron Ore Trade

Contracts have been made for 250,000 tons of ore to be shipped from Ashland,

Wis., to Canadian ports. The point of shipment indicates that the ore will come from mines on the Gogebic.

Exports and imports of iron and manganese ores in the United States four months ended Apr. 30, long tons:

	1911	1912	Changes
Iron ore, imp.....	466,105	619,782	I. 153,677
Iron ore, exp.....	10,527	27,332	I. 16,805
Manganese, imp.....	59,643	90,120	I. 30,477

Iron ore imports this year included 48,695 tons from Spain, 125,549 from Sweden and 437,850 from Cuba.

United States Foreign Trade

Exports and imports of iron and steel and of machinery in the United States for four months ended Apr. 30, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1911	1912	Changes
Exports.....	$83,807,086	$91,518,136	I. $7,711,053
Imports.....	10,413,646	8,533,623	D. 1,880,020
Excess, exp.	$73,393,440	$82,984,513	I. $9,591,073

Increase in exports, 9.4%; decrease in imports, 13.1%. The leading articles of iron and steel were, in long tons:

	Exports		Imports	
	1911	1912	1911	1912
Pig iron.....	63,114	76,343	57,662	33,475
Scrap.....	29,427	31,744	6,190	3,716
Billets, blooms, etc.	95,599	76,085	14,840	6,869
Bars.....	47,161	59,854	14,415	6,263
Rails.....	159,709	116,926	. ...	1,002
Sheets and plates..	108,645	158,632	877	1,016
Structural steel....	66,174	77,340	.....	748
Wire-rods.....	5,537	20,815	5,888	5,118
Wire.....	68,280	66,446	.....	.....
Nails and spikes..	26,205	34,290	.....	.....
Tinplates.....	15,726	26,329	8,190	746
Pipe and fittings..	54,961	77,552	.....	.....

Imports of wire are not reported in quantities; values were $143,386 in 1911 and $235,313 in 1912. Exports of mining machinery in 1912 were valued at $2,076,484, a decrease of $286,289 from last year.

METAL MARKETS

New York, June 5—The metal markets have been strong this week, generally with an advancing tendency.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Apr. 1912..	$ 1,816,816	$ 3,892,599	Imp. $2,075.783
" 1911..	1,505,634	4,524,835	Imp. 3,019,201
Year 1912..	21,774,902	16,306,794	Exp. 5,468,108
" 1911..	3,364,658	23,990,572	Imp. 20,625,914
Silver			
Apr. 1912..	4,941,259	4,189,512	Exp. 751 747
" 1911..	7,610,154	4,251,532	Exp. 3,358,622
Year 1912..	21,897,247	16,039,732	Exp. 5,857,515
" 1911..	23,611,196	14,898,313	Exp. 8,712,883

Exports from the port of New York, week ended June 1: Gold, $600; silver, $1,046,064, chiefly to London. Imports: Gold, $295,752; silver, $90,282, mainly from Central and South America.

Gold—The price of gold on the open market in London continued at the usual bank rate, 77s. 9d. per oz. for bars, and 76s. 4d. per oz. for American coin. An unusual movement was the taking of £300,000 for Turkey. In New York there was a light movement to Argentina.

Platinum—The market remains quiet, the fall demand from the jewelers not having set in yet. There are some reports of weakness in the foreign market, but there is no change here. Dealers continue to ask $45.50 per oz. for refined platinum and $48 per oz. for hard metal.

Our Russian correspondent writes, under date of May 23 that at Ekaterinburg the offers of platinum by the starateli are increasing, because most of them are at work. The quotation there for crude platinum, 83% metal, is 9.80 rubles per zolotnik—equal to $36.85 per oz. At St. Petersburg buyers are looking for lower prices, but sellers are firm, and consequently little business has been done. The quotation for crude metal is 37,500 rubles per pood—equal to $36.75 per oz. The Compagnie Industrielle du Platine, which controls 85% of the output, is putting in new machinery at its mines and expects thereby to increase production.

Iridium—The market continues unchanged and the current price is $64 per oz., New York.

Silver—Business with India during the latter part of May was quite brisk. For the beginning of June inquiries continue good, but at slightly lower figures.

SILVER AND STERLING EXCHANGE

May-June	30	31	1	3	4	5
New York....	....	61	60⅞	60⅞	60⅞	60⅞
London	28⅛	28 1/16	28	27 15/16	28 1/16	28
Sterling Ex..	....	4.8720	4.8715	4.8700	4.8695	4.8710

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to May 23, as reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India.....	£3,628,300	£2,626,300	D. £1,002,000
China.... ...	822,800	630,000	D. 192,800
Total.....	£4,451,100	£3,256,300	D. £1,194,800

India Council bills in London averaged 16d. per rupee for the week.

Gold in the United States, on May 1, is estimated by the Treasury Department as follows: Held by treasury against gold certificates outstanding, $1,034,296,369; in treasury current balances, $170,858,482; in banks and circulation, $605,360,930; total, $1,810,515,781.

Copper, Tin, Lead and Zinc

Copper—From May 29, the date of our last report, the market continued to advance, and on June 3, when the remarkably favorable European statistics became known, there was a wild upward movement in the London standard market, followed by a sharp advance in this market. On that date certain of the agencies raised their asked price to 17¼c., delivered, usual terms, but most of the agencies continued to sell at 17c. and manifested a disposition to supply copper freely in order to temper the violence of the advance. On June 4, however, 17⅛c., delivered, etc., became the prevailing price. In the aggregate a large business seems to have been transacted in spite of the advancing price. Certain agencies report a predominance of sales for export and others report a larger domestic business.

Reports received from Europe as well as in this country are all to the effect that consumption is very heavy, and manufacturers are receiving orders both for early and future shipment. In consequence, they have been in the market for

NEW YORK

May-June	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
30	.....	.....	....	....	.....	.....	.....
31	16¾ @16⅞	16.55 @16.65	45¼	4.20	4.12½ @4.15	6.70 @6.80	6.55 @6.65
1	16⅞ @17	16.70 @16.80	45¼	4.20	4.12½ @4.15	6.75 @6.85	6.60 @6.70
3	17⅛ @17¼	16.80 @16.90	45⅜	4.20	4.12½ @4.15	6.75 @6.85	6.60 @6.70
4	17⅛ @17¼	16.95 @17.00	45⅜	4.20	4.12½ @4.15	6.75 @6.85	6.60 @6.70
5	17⅛ @17¼	16.95 @17.05	45¼	4.20	4.12½ @4.15	6.75 @6.85	6.60 @6.70

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

May-June	Copper: Spot	Copper: 3 Mos	Copper: Best Sel'td	Tin: Spot	Tin: 3 Mos	Lead, Spanish	Zinc, Ordinaries
30	75 7/16	75 11/16	80⅛	203⅛	....	16⅝	25⅞
31	75 7/16	75 11/16	80⅛	200	195	16 11/16	25⅞
1	.....	.....	.....	.....	.....	.....	.....
3	76 1/16	77 1/16	82	203¼	197¼	16 11/16	25⅞
4	77⅛	77 11/16	82⅛	200¾	196	16¾	26
5	77⅞	78⅜	82⅛	200	194	16⅞	25⅞

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, ± £1 = ± 21¾c.

all deliveries, and considerable copper has already changed hands for September shipment. Producers are now well booked up; some of them are sold out for June and July, and there seems to be but little copper still unsold for August.

At the close Lake copper is quoted at 17⅛@17¼c., and electrolytic copper in cakes, wirebars and ingots at 16.95@17.05c. Casting copper is quoted nominally at 16.55@16.65c. as an average for the week.

The London standard market has been active and has steadily advanced, and it closes at £77 17s. 6d. for spot, and £78 7s. 6d. for three months. Transactions have been large.

Copper sheets have been again advanced to 22@23c. per lb., base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 18@18¼c. base, carload lots at mill.

Copper exports from New York for the week were 7366 long tons. Our special correspondent gives the exports from Baltimore at 1054 tons.

Visible stocks of copper in Europe on June 1, are reported as follows: Great Britain, 30,630; France, 5260; Rotterdam, 1750; Hamburg, 6250; afloat from Chile, 1800; afloat from Australia, 6900; total, 52,590 long tons, or 117,801,600 lb.; a decrease of 2970 tons from the May 15 report.

Tin—The London market continued to decline, and on June 3 spot closed at £203 10s. and three months at £197 5s., at which prices it ruled on June 4. On June 5 it closed at £200 for spot and £194 for three months.

The violent fluctuations of the London market have quite bewildered consumers, and they are holding off pending developments. Stocks on this side are small, and as there is little tin afloat due here in June, any increase in the demand for early shipment is likely to increase still further the premium for early deliveries. At the close, tin for early delivery is quoted at 45¼ cents.

Visible stocks of tin on June 1 were: United States, excluding Pacific ports, 3270; London, 8331; Holland, 2744; total, 14,345 long tons; an increase of 2452 tons during May.

Lead—There has been a somewhat better demand, and the market is firmer at 4.12½@4.15c., St. Louis, and 4.20c., New York.

The London market is also firmer, Spanish lead being quoted at £16 17s. 6d., and English 2s. 6d. higher.

Spelter—Certain of the leading consumers have been in the market during the last week and have purchased a considerable tonnage of spelter at advancing prices, chiefly for July and August delivery. This market continues to be erratic and a wide variation in prices is reported. We quote 6.60@6.70c., St. Louis, and $6.75@6.85c., New York.

The London market is also higher, good ordinaries being quoted at £25 17s. 6d., and specials at £26 2s. 6d. per ton.

Base price of zinc sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7⅛@7⅛c. per lb., New York, in carload lots.

Other Metals

Aluminum—Trade in New York is fair. The low-priced lots which have been holding down the market are apparently cleaned out, and prices have advanced to about the level set by the convention abroad. We quote 22½@23c. per lb. for No. 1 ingots, New York.

Antimony—Business remains about the same, and the market is steady at last prices. Cookson's is held at 8c. per lb. and Hallett's at 7¾c., while 7⅛@7¼c. are asked for Chinese, Hungarian and other outside brands.

Quicksilver—Business is fair and the market steady. New York quotations are $41@42 per flask of 75 lb., with 60c. per lb. charged for retail lots. San Francisco, $41.50 for domestic orders and $39 for export. The London price is £8 5s. per flask, with £8 2s. 6d. quoted from second hands.

Nickel—Large lots, contract business, 40@50c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Imports and Exports of Metals

Exports and imports of metals in the United States, four months ended Apr. 30, are reported as follows, in the measures usual in the trade:

Metals	Exports	Imports	Excess
Copper, long tons	119,129	64,064	Exp. 55,065
Copper, 1911	107,855	51,364	Exp. 56,491
Tin, long tons	250	18,856	Imp. 18,606
Tin, 1911	137	17,748	Imp. 17,611
Lead, short tons	24,799	32,413	Imp. 7,614
Lead, 1911	28,047	32,774	Imp. 4,727
Zinc, short tons	4,579	2,220	Exp. 2,359
Zinc, 1911	1,621	800	Exp. 821
Nickel, lb.	8,927,231	11,798,334	Imp. 2,871,103
Nickel, 1911	7,669,531	9,341,802	Imp. 1,672,271
Antimony, lb.	40,320	5,355,172	Imp. 5,314,852
Antimony, 1911	150,704	2,614,125	Imp. 2,463,421
Platinum, oz.	.....	30,732	Imp. 30,732
Platinum, 1911	47	33,854	Imp. 33,807
Aluminum, lb.	9,656	9,383,070	Imp. 9,373,414
Aluminum, 1911	.....	.....	.....
Ores, etc.			
Zinc in ore, lb.	10,353,607	9,842,887	Exp. 510,720
In ore, 1911	7,702,936	12,364,108	Imp. 4,661,172
Zinc oxide, lb.	12,468,255	.....	Exp. 12,468,255
Zinc oxide, '11	12,033,157	.....	Exp. 12,033,157
Zinc dross, lb.	384,695	.....	Exp. 384,695
Zinc dross, '11	1,551,837	.....	Exp. 1,551,827
Chrome ore, l.t.	.....	18,351	Imp. 18,351
Chrome ore, '11	.....	11,479	Imp. 11,479

Copper, lead, nickel and antimony include the metal contents of ores, matte, bullion, etc. Quantity of antimony ore is not reported. Quantity of zinc ore imported in 1912 was 19,175 tons; exported, 9182. Imports of aluminum were not reported previous to July 1, 1911. The metal exports given above include reexports of foreign materials.

Zinc and Lead Ore Markets

Joplin, Mo., June 1—The high price of zinc sulphide ore this week is $61, the base per ton of 60% zinc $54@58.50. Zinc silicate sold at $27@30 per ton of 40% zinc. The average price, all grades, was $54.44. The high price of lead ore is $56, and the average price, all grades, was $52.84 per ton.

SHIPMENTS, WEEK ENDED JUNE 1

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	3,997,070	.....	1,104,040	$141,725
Joplin	2,013,590	.....	323,440	64,788
Galena	643,070	.....	250,300	24,512
Alba-Neck	626,350	.....	.....	18,163
Duenweg	530,330	.....	18,390	15,326
Oronogo	452,520	.....	139,140	14,531
Miami	345,750	.....	229,930	14,254
Carl Junction	342,120	.....	54,070	11,641
Spurgeon	185,520	189,010	115,970	10,858
Cave Springs	293,820	.....	.....	8,520
Granby	113,700	210,520	.....	5,540
Springfield	86,000	.....	85,000	4,800
Jackson	121,220	.....	9,040	3,496
Sarcoxie	72,330	.....	.....	1,952
Lawton	60,190	.....	.....	1,684
Wentworth	63,710	.....	.....	1,600
Quapaw	52,130	.....	.....	1,303
Aurora	51,810	.....	.....	1,295
Totals	10,051,390	399,530	2,329,320	$345,990
22 weeks	222,021,800	13,225,210	37,535,980	$6,699,351

Blende val., the week, $278,525; 22 weeks, $4,483,743
Calamine, the week, 5,925; 22 weeks, 193,612
Lead value, the week, 61,540; 22 weeks, 1,022,096

MONTHLY AVERAGE PRICES

Month	Zinc Ore Base Price		Zinc Ore All Ores		Lead Ore All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February	40.21	45.75	39.16	43.31	54.46	52.39
March	39.85	51.56	38.45	49.25	54.57	54.64
April	38.88	52.00	37.47	50.36	56.37	54.18
May	38.25	55.30	36.79	53.27	55.21	52.45
June	40.50	.....	38.18	.....	56.49	.....
July	40.75	.....	38.36	.....	58.81	.....
August	42.50	.....	41.28	.....	60.74	.....
September	42.63	.....	41.29	.....	59.33	.....
October	42.38	.....	40.89	.....	54.72	.....
November	45.40	.....	43.28	.....	57.19	.....
December	44.13	.....	40.76	.....	62.03	.....
Year	$41.45	.....	$39.90	.....	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., June 1—The highest price paid this week for zinc ore was $56 per ton; the base price, 60% inc, was $55@55.50. The base price paid for 80% lead ore was $52@53 per ton. The high price of zinc ore and the shortage of supply, particularly of lower grades, has stimulated the mining industry and much prospecting is again in evidence.

SHIPMENTS, WEEK ENDED JUNE 1

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	979,830	.....	.....
Benton	954,200	62,500	590,300
Platteville	622,600	.....	250,000
Cuba City	351,470	117,940	151,900
Galena	336,900	.....	.....
Shullsburg	319,000	64,000	.....
Hazel Green	265,000	134,500	.....
Linden	168,250	.....	60,000
Harker	127,480	.....	.....
Dodgeville	.....	111,300	.....
Total	4,124,730	490,240	1,052,200
Year to date	85,745,230	3,572,410	11,557,450

Shipped during week to separating plants, 1,621,020 lb. inc ore.

Chemicals

New York, June 5—The general market continues fairly active, and a good business in heavy chemicals is reported.

Copper Sulphate—The market is strong and prices are unchanged. An advance is expected on account of the rise in copper metal.

Arsenic—White arsenic is quoted at $3.87½c., nominally, for spot, but there is none to be had. Futures are quoted at $3.50 per 100 lb. Mexican supplies are said to be on the way, but no receipts have been reported. The Anaconda company promises July deliveries. For some unknown reason, Canadian producers seem to be unable to ship and have made purchases in England against their July contracts. Some English arsenic is coming here for the first time in three years. Meantime, the market is practically bare.

CURRENT WHOLESALE PRICES

Ammonium sulphate ..... cwt.	3.27½@3.35
Arsenic, white ..... lb.	0.03½@0.03¾
Barytes, ground ..... sh. ton	12.50@14.00
" floated ..... sh. ton	16.00@17.00
Calcium acetate, gray ..... cwt.	2.50@2.55
carbide, tons lot f.o.b. Niagara Falls ... sh. ton	70.00
Carbons, good drill quality .... carat	75.00@85.00
Cement, Port., Am. ..... 400-lb. bbl.	1.33
Chrome brick, f.o.b., Pittsburg ... M.	175.00
ore, 50%, ex-ship, N. Y., lg. ton	14.00@16.00
Copperas, bulk ..... cwt.	0.55
bbl. ..... cwt.	0.60@0.85
Cpoper sulphate ..... cwt.	5.25@5.50
Fluorspar, lump, f.o.b. Pittsburg. ton	8.00@9.00
Magnesite, crude, 95% ..... lg. ton	7.50@8.50
calcined, powdered	26.00@35.00
brick, dom., f.o.b. Pittsburg ..... M.	160@180
Paints, litharge, Am. powd ..... lb.	0.05½@0.06
red lead, American ..... lb.	0.06½@0.07
white lead, Am., dry ..... lb.	0.05½@0.05¾
zinc white, Am., dry ..... lb.	0.05½@0.05¾
zinc white, Am., dry ..... lb.	0.05½@0.06¼
Phosphates, acid:	
*Fla., hard rock 77%	5.75@6.25
land pebble 68%	3.70@3.80
†Tenn., 78@80%	5.00@5.50
75%	4.75@5.00
68@72%	4.25@4.50
‡So. Car. land rock 60%	3.50@3.75
Potassium cyanide, 98@99% .... lb.	0.19
Pyrite:	
Domestic, non-arsenical, furnace size, f.o.b. R.R. per unit	0.12@0.12½
Domestic, non-arsenical, fines, per unit, f.o.b. mines	0.11½@0.12
Imported, non-arsenical, furnace size, ex-ship, per unit	0.13½
Imported, arsenical, furnace size, size, ex-ship, per unit	0.12½@0.13
Imported, fines, arsenical, ex-ship.	0.11@0.12
Imported, fines non-arsenical, ex-ship, per unit	0.12½

Pyrite prices are per unit of sulphur. A deduction of 25c. per ton is made when ore is delivered in large lumps.

Sodium cyanide, 120 to 130% KCN (per 100%) ..... lb.	0.18
nitrate 95% spot ..... cwt.	2.40@2.42½
95% future .... cwt.	2.45@2.47½
Sulphur, Louisiana prime, N. Y, lg. ton	22.00@22.50
roll ..... cwt.	1.85@2.15
flour ..... cwt.	2.00@2.40
flowers, sublimed ..... cwt.	2.20@2.60
pow. com., bags ..... cwt.	1.50
Sicilian, crude brimstone lg. ton	22.50
Zinc chloride, granular ..... lb.	0.04½@0.04¾

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S.C.

Note—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in their selling output on private contract.

Petroleum

California production in April is reported at 7,208,672 bbl.; deliveries, 6,406,913 bbl. Stocks on Apr. 30 were 43,387,622 bbl. During April there were 75 wells completed and 11 abandoned. On Apr. 30 there were 5316 wells producing.

MINING STOCKS

New York, June 5—On May 31, the Exchange opened weak after the holiday of the previous day. There was heavy selling and a recession in prices on all the prominent stocks. On the Curb there was a fair business in coppers with no material change in quotations. Cobalts were off a little, while other mining stocks were dull and weak.

June 1 the Exchange was still heavy and weak, with declines in prices on all sides in a market mainly professional. On the Curb, mining stocks were dull and generally off in price. A new stock, Butte & New York, made its appearance.

June 3 the Exchange was quiet with few price changes. The Curb showed fair dealings in mining stocks. Copper shares were rather heavy; Kerr Lake advanced, but other Cobalts were unchanged.

June 4 there was a general recovery on the Exchange, mainly on inside trading. The Curb was firmer and mining stocks more in demand, especially the copper stocks, which generally advanced in prices. On June 5, both Curb and Exchange were fairly strong.

The Transactions on the New York Stock Exchange for the month of May amounted to 12,832,000 shares, against 15,855,000 in April and 11,608,000 shares in May, 1911. Dealings in bonds aggregated $60,500,000, against $65,100,000 in April, and $91,500,000 in May of last year.

Boston, June 4—Little consolation could be derived from the copper-share market until today, when some active and strong spots developed. It is noticeable, perhaps, that the continued advance of copper has resulted in the withdrawal of many selling orders which is certainly a good sign. Any demand for a stock causes a sharp advance although the lethargy is pronounced.

Calumet & Arizona has been the most active issue, advancing $3.25 to $76.50 on anticipation that the dividend would be increased, but the failure to increase the payment caused some realizing. The declaration of the usual 50c. quarterly rate by the Copper Range Consolidated failed to exert any influence on the price of the shares. Those aristocrats, Calumet & Hecla and Ahmeek, have made a good record during the week, the former going to $500 per share, the first time this year. This is an advance of $15. Ahmeek is up $30 to $345, a record price.

Butte & Superior has been a prominent feature, advancing $6.25 to $42.50. This

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	March	April	May
Alaska shipments.	4,987,916	1,243,911	.....
Anaconda	25,900,000	25,480,000	25,800,000
Arizona, Ltd.	3,150 000	3,400,000	.....
Copper Queen	7,197,121	6,806,425	7,024,087
Calumet & Ariz.	4,652,000	4,104,000	4,424,000
Chino	1,108,381	.....	.....
Detroit	2,246,238	2,506,718	2,092,478
East Butte	1,480,000	.....	.....
Mammoth	1,939,310	1,718,450	.....
Mason Valley	1,140,000	.....	.....
Nevada Con	6,380,000	6,115,095	.....
Old Dominion	2,432,000	2,167,000	.....
Ray	2,300,000	2,612,500	.....
Shannon	1,388,000	1,544,000	1,464,000
South Utah	299,000	284,215	.....
United Verde*	2,250,000	.....	.....
Utah Copper Co. ...	8,160,000	8,615,775	.....
Lake Superior*	19,750,000	18,250,000	.....
Non-rep. mines* ...	7,291,619	8,250,000	.....
Total production.	104,051,585	.....	.....
Imports, bars, etc..	23,519,215	26,842,014	.....
Total blister	127,570,800	.....	.....
Imp. in ore & matte	8,736,874	9,350,972	.....
Total	136,307,674	.....	.....
Miami	2,755,000	2,554,352	.....
Brit. Col. Cos.:			
British Col. Copper	.....	.....	.....
Granby	1,882,073	1,941,797	.....
Mexican Cos.:			
Boleo	2,424,800	2,149,280	.....
Cananea	2,834,000	4,654,000	.....
Moctezuma	2,446,731	2,797,718	2,892,521
Other Foreign:			
Cape Cop., S. Africa	725,760	954,240	.....
Kyshtim, Russia...	.....	1,545,000	.....
Spassky, Russia....	638,400	649,600	.....
Famatina, Argen..	.....	.....	.....
Tilt Cove, Newf'd..	104,992	119,869	.....
Exports from:			
Chile	3,584,000	6,496,000	.....
Australia	8,064,000	9,408,000	.....
Arrivals in Europe†	12,559,680	12,064,640	.....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
V, 1911	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566
IV	125,464,644	69,513,846	53,252,326
V	.....	.....	.....

VISIBLE STOCKS

	United States	Europe	Total
VI, 1911	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,388
IV	62,367,557	136,819,200	199,186,757
V	65,066,029	134,176,000	199,242,029
VI	.....	117,801,600	.....

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

is a prosperous zinc proposition, recently floated. Old Dominion rose to $59.25 on the increasing of the quarterly dividend rate. Boswyocolo fell to 2c. against a selling price just under 10c. a short time ago. Old Dominion receipts have dropped back.

Assessments

Company	Delinq	Sale	Amt
Alpha Con., Nev.	May 29	June 19	$0.05
Andes, Nev.	May 28	June 18	0.05
Best & Belcher, Nev	June 3	June 27	0.10
Bingham Copper, Utah	June 1		0.05
Black Horse, Ida.			0.02
Black Jack, Utah,	Feb. 6		0.01
Caledonia, Nev.	May 21	June 11	0.10
Cedar-Talisman, Utah	Apr. 20		0.005
Challange, Nev.	June 8	June 11	0.10
East Tintic, Utah	May 30	June 25	0.005
Ely Con., Nev			0.05
Exchequer, Nev	May 23	June 13	0.05
Federal Ely, Utah	May 8	June 8	0.01
Glen Dale, Utah	May 25	June 25	0.00
Houghton Copper, Mich	May 17		1.00
Julia, Nev.	May 15	June 5	0.05
Lehi Tintic, Utah	Feb. 29		0.01
Lower Mammoth, Utah	Mar. 16		0.01
New York Bonanza, Utah	May 8		0.02
Ojibway, Mich.	Jan. 10		1.00
Raven, Mont.	Feb. 1		0.10½
Savage, Nev.	June 4	June 26	0.105
Segregated Belcher, Nev.	June 1	June 28	0.05
South Lake, Mich.	June 3		2.00
Southwestern Miami, Ariz.	Jan. 15		1.00
Tintic Central, Utah	June 14	July 6	0.005
Union Con., Nev.	May 9	May 31	0.15
Utah Antimony, Utah	June 1		0.03

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24.483	24.595	27.284
May	53.870	53.308	60.880	24.797	24.583	28 038
June	53.462	53.043		24.651	24.486	
July	54.150	52.630		25.034	24.286	
August	52.912	52.171		24.428	24.082	
September	53.295	52.440		24.567	24.209	
October	55.490	53.340		25.596	24.594	
November	55.635	55.719		25.680	25.649	
December	54.428	54.905		25.160	25.349	
Year	53.486	53.304		24.670	24.592	

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62.893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	15.741	12.275	15.930	54.034	70.294
May	11.989	16.031	12.214	16.245	54.313	72.352
June	12.385		12.611		56.365	
July	12.463		12.720		56.673	
August	12.405		12.634		56.266	
September	12.201		12.508		55.253	
October	12.189		12.370		55.170	
November	12.616		12.769		57.253	
December	13.552		13.768		62.068	
Year	12.376		12.634		55.973	

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42.529	July	42.400	
February	41.614	42.962	August	43.319	
March	40.157	42.577	September	39.755	
April	42.185	43.923	October	41.185	
May	43.115	46.053	November	43.125	
June	44.606		December	44.655	
			Av. Year	42.281	

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412	4.200	4.262	4.118	12.889	16.331
May	4.373	4.194	4.223	4.072	12.984	16.509
June	4.435		4.292		13.260	
July	4.499		4.397		13.530	
August	4.500		4.406		14.260	
September	4.485		4.356		14.744	
October	4.265		4.139		15.332	
November	4.298		4.181		15.821	
December	4.450		4.332		15.648	
Year	4.420		4.286		13.970	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399	6.633	5.249	6.483	23.743	25.644
May	5.348	6.679	5.198	6.529	24.375	25.790
June	5.520		5.370		24.612	
July	5.695		5.545		25.006	
August	5.953		5.803		26.801	
September	5.869		5.719		27.750	
October	6.102		5.951		27.256	
November	6.380		6.223		26.795	
December	6.301		6.151		26.849	
Year	5.758		5.608		25.281	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90	15.13	14.65	13.90	15.00	14.15
May	15.90	15.14	14.30	13.90	14.72	14.12
June	15.90		14.06		14.56	
July	15.90		14.03		14.53	
August	15.90		14.00		14.47	
September	15.90		13.87		14.40	
October	15.43		13.44		14.34	
November	14.92		13.30		14.25	
December	15.15		13.10		13.90	
Year	$15.72		$13.94		$14.49	

STOCK QUOTATIONS

COLO. SPRINGS June 4

Name of Comp.	Bid.
Acacia	.05⅝
Cripple Cr'k Con.	.01⅞
C. K. & N.	.17½
Doctor Jack Pot	.06
Elkton Con.	.65
El Paso	.69½
Findlay	.04
Gold Dollar	.17
Gold Sovereign	.01⅛
Isabella	.11
Jack Pot	.04
Jennie Sample	.04½
Lexington	.02
Moon Anchor	.01
Old Gold	.03½
Mary McKinney	.71
Pharmacist	.01⅜
Portland	.90
Vindicator	.79½
Work	.01

SALT LAKE June 4

Name of Comp.	Bid.
Beck Tunnel	.11
Black Jack	.15½
Cedar Talisman	.02
Colorado Mining	.18
Columbus Con.	‡.14
Crown Point	.02½
Daly-Judge	6.25
Grand Central	.72
Iron Blossom	1.22½
Little Bell	.41
Mammoth	‡.02
Mason Valley	‡11.50
May Day	.09½
Nevada Hills	‡1.95
New York	‡.04½
Prince Con	1.55
Silver King Coal'n	2.30
Sioux Con.	.05
Uncle Sam	.19
Yankee	‡.10

TORONTO June 4

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	‡6.90	Hollinger	10.50
Hudson Bay	‡70.00	Imperial	.03
Temiskaming	.41	Pearl Lake	.18
Wettlaufer-Lor.	.58	Porcu. Gold	.40
Apex	.03	Porcu. Tisdale	.01
Central	‡5.56	Preston E. D.	.04
Crown Chartered	.14	Rea	.25
Dobie	.25	Standard	‡.04
Dome Exten.	.33	Swastika	.15
Foley O'Brien	.18	West Dome	.15

SAN FRANCISCO June 4

Name of Comp.	Clg.
COMSTOCK STOCKS	
Alta	.06
Belcher	.45
Best & Belcher	.14
Caledonia	1.30
Challenge Con.	.03
Chollar	.03
Confidence	.60
Con. Virginia	.58
Crown Point	.42
Gould & Curry	.04
Hale & Norcross	.16
Mexican	2.82½
Occidental	.55
Ophir	1.15
Overman	1.00
Potosi	.04
Savage	.15
Sierra Nevada	.21
Union Con.	.84
Yellow Jacket	.55

Name of Comp.	Bid
MISC. NEV. & CAL.	
Belmont	10.00
Jim Butler	.51
MacNamara	.25
Midway	.51
Mont.-Tonopah	2.87½
North Star	.19
West End Con.	2.05
Atlanta	.27
Booth	.10
C.O.D. Con.	.10
Comb. Frac.	.17
Jumbo Extension	.36
Pitts.-Silver Peak	1.22½
Silver Pick	.14
St. Ives	.35
Tramp Con.	‡.01
Argonaut	‡2.00
Bunker Hill	‡4.50
Cent. Eureka	‡.72
So. Eureka	3.12

N. Y. EXCH. June 4

Name of Comp.	Clg.
Amalgamated	84
Am. Agri. Chem.	61
Am.Sm.&Ref.,com	84
Am. Sm. & Ref., pf.	107
Am. Sm. Sec., pf. B	88⅛
Anaconda	42⅞
Batopilas Min.	1⅛
BethlehemSteelpf	70
Chino	30⅝
Comstock Tunnel	‡.10
Federal M. & S., pf.	41
Goldfield Con.	4⅜
GreatNor.,ore,ctf.	42
Homestake	93
Inspiration Con.	18¼
Miami Copper	26⅜
Nat'nalLead,com.	57⅛
National Lead, pf.	107⅛
Nev. Consol.	22½
Pittsburg Coal, pf.	90⅜
Ray Con	19
RepublicI&S,com.	24⅛
Republic I & S, pf.	80¼
SlossSheffi'd,com.	50
Sloss Sheffield, pf.	90
Tennessee Copper	44⅛
Utah Copper	63¾
U. S. Steel, com	68⅛
U. S. Steel, pf.	110⅝
Va. Car. Chem.	51⅛

BOSTON EXCH. June 4

Name of Comp.	Clg.
Adventure	8½
Ahmeek	340
Algomah	7
Allouez	45
Am. Zinc	29⅛
Ariz. Com., ctfs.	5¾
Bonanza	.40
Boston & Corbin	7
Butte & Balak.	4⅛
Calumet & Ariz	75⅝
Calumet & Hecla	490
Centennial	25
Con. Mercur	.05
Copper Range	58⅜
Daly West	5⅜
East Butte	13⅜
Franklin	12⅛
Granby	54
Hancock	33
Hedley Gold	16½
Helvetia	1⅛
Indiana	19¼
Island Cr'k, com.	55
Island Cr'k, pfd.	89
Isle Royale	29
Keweenaw	1⅜
Lake	40
La Salle	6¼
Mass	7¼
Michigan	3
Mohawk	65
New Arcadian	4⅜
New Idria Quick.	6⅜
North Butte	29⅜
North Lake	6¼
Ojibway	4⅜
Old Dominion	59¾
Osceola	122
Quincy	89½
Shannon	15⅜
Shattuck-Ariz.	21¼
Superior	35
Superior & Bost.	2
Tamarack	44½
Trinity	6⅜
Tuolumne	3½
U. S. Smelting	38¾
U. S. Smelt'g, pf.	49
Utah Apex	2⅜
Utah Con.	13⅜
Victoria	3⅝
Winona	6¾
Wolverine	110
Wyandot	2⅞

N. Y. CURB June 4

Name of Comp.	Clg.
Barnes King	‡.30
Beaver Con.	.46
Braden Copper	6⅞
B. C. Copper	5¾
Buffalo Mines	‡1⅛
Caledonia	⅜
Con. Ariz. Sm.	⅝
Davis-Daly	2 1/16
Diam'field-Daisy	13
Ely Con	1/16
Florence	1
Giroux	5⅛
Gold Hill Con.	1/16
Greene Cananea	10
Greenwater	.06
Guggen. Exp.	223
Internat. S. & R.	124
Kerr Lake	2¾
Keystone	2⅛
La Rose	3⅛
McKinley-Dar-Sa.	1¾
Min. Co. of A. new	3
Motherlode Gold	1/16
Nev. Utah M. & S.	05
Nipissing Mines	7⅜
Ohio Copper	1⅛
Pacific Sm. & M.	1/16
Ray Central	‡2⅜
South Live Oak	3⅜
South Utah M. & S.	¾
Standard Oil (Old)	865
Stand'd Oil of N.J.	377½
Stand'd Oil Subs.	490
Stewart	1 1/16
Tonopah	7
Tonopah Ex.	2 3/32
Tri-Bullion	1/16
Tularosa	‡1/16
Union Mines	1/16
United Cop., pfd.	10
Yukon Gold	3⅜

BOSTON CURB June 4

Name of Comp.	Last
Bingham Mines	2¼
Boston Ely	1⅛
Boswyocolo	.05½
Butte Central	6½
Cactus	.11
Calaveras	2¼
Chief Cons	1½
Corbin	2⅞
Cortez	1⅞
Crown Reserve	3½
First Nat. Cop.	2¼
Majestic	.54
Mazatan	.50
Moneta Porc.	‡.11
Nevada-Douglas	3¼
New Baltic	3¼
Oneco	2
Raven Copper	.31
Rhode Island Coal	.32
San Antonio	‡3
S. W. Miami	7⅛
South Lake	9
Trethewey	2⅛
United Verde Ext.	.35
Vulture	$5.00

LONDON June 5

Name of Com.	Clg.
Camp Bird	£1 10s 0d
Dolores	1 10 0
El Oro	0 17 0
Esperanza	1 10 0
Mexico Mines	7 5 0
Oroville	0 4 6
Stratton'sInd.	0 3 1½
Tomboy	1 4 4½

‡Last quotation.

Mining Companies—United States

Name of Company and Situation		Shares Issued	Shares Par Val	Dividends Total to Date	Dividends Latest Date	Dividends Latest Amt
Acacia, g.	Colo.	1,438,989	$ 1	$ 129,618	Jan. '11	$0.01
Adams, s.l.c.	Colo.	80,000	10	778,000	Dec. '09	0.04
Ahmeek, c.	Mich.	50,000	25	450,000	Apr. '12	4.00
Alaska Mexican, g.	Alas.	180,000	5	2,976,381	May '12	0.40
Alaska Treadwell, g.	Alas.	200,000	25	12,360,000	May '12	0.75
Alaska United, g.	Alas.	180,200	5	982,090	May '12	0.50
Am. Zinc, Lead & Sm.	U. S.	84,000	25	648,540	Apr. '12	0.50
Anaconda, c.	Mont.	4,332,500	25	63,005,000	Apr. '12	0.50
Argonaut, g.	Cal.	200,000	5	1,200,000	June '10	0.05
Arizona Copper, pf.	Ariz.	1,426,120	1.20	2,003,391	May '12	0.047
Arizona Copper, com.	Ariz.	1,519,896	1.20	14,230,128	Feb. '12	0.30
Bagdad-Chase, g., pf.	Cal.	84,819	5	202,394	Jan. '09	0.10
Baltic, c.	Mich.	100,000	25	7,050,000	June '11	5.00
Bingham N. H., c.	Utah.	228,690	5	248,481	Mar. '12	0.10
Bonanza Dev., g.	Colo.	300,000	1	1,425,000	Oct. '11	0.20
Bunker Hill Con., g.	Cal.	200,000	1	606,000	May '12	0.07½
Bunker Hill & Sul., l.s.	Ida.	327,000	10	13,453,950	May '12	0.20
Butte & Ballaklava, c.	Mont.	250,000	10	125,000	Aug. '10	0.50
Caledonia, l.s.c.	Ida.	1,300,000	1	52,000	June '10	0.01
Calumet & Arizona, c.	Ariz.	650,000	10	14,285,412	Mar. '12	1.00
Calumet & Hecla, c.	Mich.	100,000	25	116,650,000	Mar. '12	8.00
Camp Bird, g.s.	Colo.	1,100,000	5	7,848,900	Feb. '12	0.48
Centen'l-Eur., l.s.g.c.	Utah.	100,000	5	3,450,000	Apr. '12	1.50
Center Creek, l.s.	Mo.	100,000	10	435,000	Apr. '12	0.05
Champion, c.	Mich.	100,000	25	7,000,000	May '12	1.00
Cliff, g.	Utah.	300,000	1	90,000	Feb. '12	0.10
Cliff, g.	Alas.	100,000	1	140,000	May '11	0.25
Colo. Gold Dredging	Colo.	100,000	10	125,000	Sept. '11	0.25
Colorado, l.s.g.	Utah.	1,000,000	0.20	2,480,000	Mar. '12	0.03
Columbus Con., g.s.	Utah.	285,540	5	226,832	Oct. '07	0.20
Commercial Gold	Ore.	1,750,000	1	43,750	Dec. '10	0.00½
Con. Mercur., g.	Utah.	1,000,000	1	3,415,313	July '12	0.03
Continental, s. l.	Mo.	22,000	25	264,000	Jan. '12	0.50
Copper Range Con., c.	Mich.	393,445	100	12,507,265	Apr. '12	0.50
Daly Judge, s.l.	Utah.	300,000	1	315,000	Apr. '12	0.15
Daly West, s.l.	Utah.	180,000	20	6,484,000	Apr. '12	0.30
Doctor Jackpot, g.	Colo.	3,000,000	0.10	90,000	Mar. '11	0.00½
Doe Run, l.	Mo.	65,782	100	2,941,850	Mar. '12	1.50
Elkton Con., g.	Colo.	2,500,000	1	2,991,960	May '12	0.01
El Paso, g.	Colo.	2,450,000	1	1,523,795	Apr. '12	0.01
Fed. M. & S., com.	Idaho.	60,000	100	2,708,750	Jan. '09	1.50
Fed. M. & S., pf.	Idaho.	120,000	100	7,031,250	Mar. '12	1.75
Florence, g.	Nev.	1,050,000	1	840,000	Apr. '11	0.10
Frances-Mohawk, g.	Nev.	912,000	1	546,000	Jan. '08	0.05
Free Coinage, g.	Colo.	10,000	100	180,000	Dec. '09	1.00
Fremont Con., g.	Calif.	200,000	2.50	142,000	May '12	0.02
Frontier, s.	Wis.	1,250	100	133,772	May '12	2.00
Gemini-Key'ne, l.g.s.	Utah.	5,000	100	2,130,000	Oct. '11	6.00
Gold Coin of Victor	Colo.	1,000,000	1	1,350,000	Feb. '09	0.02
Gold King Con., g.	Colo.	5,750,370	1	1,407,319	Dec. '11	0.03
Golden Cycle, g.	Colo.	1,500,000	5	1,980,000	May '12	0.02
Golden Star, g.	Ariz.	400,000	5	140,000	Mar. '10	0.05
Goldfield Con., g.	Nev.	3,558,367	10	21,703,578	Apr. '12	0.50
Grand Central, g.	Utah.	500,000	1	1,356,250	Dec. '11	0.05
Granite, g.	Colo.	1,650,000	1	253,000	Dec. '10	0.01
Hazel, g.	Cal.	900,000	1	711,000	Dec. '10	0.00½
Hecla, l.s.	Idaho.	1,000,000	0.25	2,450,000	May '12	0.02
Hercules, l.s.	Idaho.	1,000,000	1	3,650,000	July '11	0.06
Homestake, g.	S. D.	218,400	100	28,085,040	May '12	0.50
Iowa, g.s.l.	Colo.	1,666,667	1	200,166	June '11	0.00½
Iowa-Tiger Leasing g.s.	Colo.	12,655	1	13,921	Jan. '12	0.10
Iron Blossom, s.l.g.	Utah.	1,000,000	0.10	1,170,000	Apr. '12	0.10
Iron Silver, s.l.g.	Colo.	500,000	20	4,500,000	Jan. '12	0.10
Jamison, g.	Cal.	390,000	10	378,300	Jan. '11	0.02
Jerry Johnson, g.	Colo.	2,500,000	0.10	150,000	Aug. '11	0.01
Kendall, g.	Mont.	500,000	5	1,375,000	Jan. '12	0.02
Kennedy, g.	Cal.	100,000	100	1,831,001	Apr. '10	0.03
King of Arizona, g.	Ariz.	200,000	1	396,000	Aug. '09	0.12
Knob Hill, g.	Wash.	1,000,000	1	45,000	May '12	0.00½
Liberty Bell, g.	Colo.	130,551	5	522,093	Oct. '10	1.00
Little Bell, l.s.	Utah.	300,000	1	75,000	Mar. '11	0.05
Little Florence, g.	Nev.	1,000,000	1	430,000	Jan. '08	0.03
Mammoth, g.s.c.	Utah.	400,000	25	2,220,000	Mar. '08	0.05
Mary McKinney, g.	Colo.	1,309,252	1	933,641	Apr. '12	0.02
May Day, g.s.l.	Utah.	800,000	0.25	108,000	Sept. '08	0.01½
Mexican, g.s.	Nev.	201,600	2.50	20,160	Aug. '11	0.10
Miami, c.	Ariz.	664,993	5	332,496	May '12	0.50
Modoc, g.s.	Colo.	500,000	1	275,000	Dec. '11	0.01
Mohawk M. Co.	Mich.	100,000	25	2,425,000	Feb. '12	1.00
Monarch-Mad'a, g.s.l.	Colo.	1,000,000	1	40,000	May '11	0.01
Montana-Tonop., s.g.	Nev.	921,865	1	330,000	Dec. '11	0.06
Mountain, c.	Cal.	250,000	25	4,216,250	May '08	0.44
National, g.	Nev.	750,000	1	570,000	May '11	0.10
Nevada Con., c.	Nev.	1,999,394	5	7,479,313	Mar. '12	0.37½
New Century, s.l.	Mo.	330,000	1	237,600	Oct. '09	0.01
New Idria, q.	Cal.	100,000	5	1,540,000	Apr. '12	0.30
North Butte, c.	Mont.	410,000	15	10,043,000	Apr. '12	0.40
North Star, g.	Cal.	250,000	10	3,511,988	Mar. '12	0.10
Old Domin'n, M. & Sm.	Ariz.	162,000	25	2,146,000	Apr. '12	1.00
Ophir, s. g.	Nev.	201,600	3	2,068,360	Jan. '12	0.10
Opohongo, g.s.l.	Utah.	898,978	0.25	26,969	Apr. '12	0.01
Oroville Dredging	Cal.	700,000	5	1,383,036	Dec. '09	0.12½
Osceola, c.	Mich.	96,150	25	10,016,300	Jan. '12	3.50
Parrot, c.	Mont.	229,850	10	7,080,465	May '12	0.15
Pearl Con., g.	Wash.	1,909,711	0.05	181,422	Dec. '10	0.02
Pharmacist, g.	Colo.	1,500,000	1	87,500	Feb. '10	0.00½
Pioneer, g.	Alas.	5,000,000	1	2,041,526	Oct. '11	0.03
Pittsburgh-Idaho, l.	Ida.	1,000,000	1	120,450	Apr. '12	0.04
Portland, g.	Colo.	3,000,000	1	9,037,080	Apr. '12	0.02
Quilp.	Wash.	1,500,000	1	67,500	Feb. '12	0.01
Quincy, c.	Mich.	110,000	25	19,990,000	Mar. '12	1.00
Republic, g.	Wash.	1,000,000	1	85,000	Dec. '10	0.01½
Rochester, l.s.	Mo.	4,900	100	188,396	Dec. '10	0.50
Round Mountain, g.	Nev.	866,426	1	328,404	Sept. '10	0.04
St. Joseph, l.	Mo.	1,000,000	10	8,108,357	Mar. '12	0.15
Shannon, c.	Ariz.	300,000	10	450,000	July '07	0.50
Shattuck-Arizona, c.	Ariz.	350,000	10	1,050,000	Jan. '11	1.00
Silver King Coal. l.s.	Utah.	1,250,000	5	1,659,885	Jan. '10	0.15
Sioux Con., s.l.g.	Utah.	745,389	1	872,097	July '11	0.04
Skidoo, g.	Cal.	1,000,000	5	175,000	July '11	0.07½
Smuggler, l.s.z.	Colo.	1,000,000	1	2,235,000	Nov. '06	0.03

Mining Companies—United States—(*Continued*)

Name of Company and Situation		Shares Issued	Shares Par Val	Dividends Total to Date	Dividends Latest Date	Dividends Latest Amt
Snowstorm, c.g.	Ida.	1,500,000	$ 1	$ 1,005,000	Aug. '10	$0.01
South Eureka, g.	Calif.	299,981	1	366,881	Apr. '12	0.07
Standard Con., g.s.	Cal.	178,394	10	5,229,809	Jan. '12	0.10
Stratton's Ind., g.	Colo.	1,000,000	0.60	364,500	Apr. '12	0.06
Success, s.	Ida.	1,500,000	1	730,000	May '12	0.02
Tamarack, c.	Mich.	60,000	25	9,420,000	July '07	4.00
Tennessee, c.	Tenn.	200,000	25	2,906,520	Feb. '12	1.50
Tomboy, g. s.	Colo.	300,000	4.85	2,843,100	Dec. '11	0.24
Tom Reed, g.	Ariz.	909,555	1	591,296	Apr. '12	0.04
Tonopah Belm't, s.g.	Nev.	1,500,000	1	2,843,003	Apr. '12	0.25
Tonopah of Nev., s.g.	Nev.	1,000,000	1	8,850,000	Apr. '12	0.40
Tri-Mountain, c.	Mich.	100,000	25	950,000	Dec. '10	1.00
Tuolumne, c.	Mont.	800,000	1	360,000	Aug. '11	0.15
Uncle Sam, g. s. l.	Utah.	500,000	1	495,000	Sept. '11	0.05
United (Crip. Ck.) g.	Colo.	4,000,100	1	440,435	Jan. '10	0.04
United Globe, c.	Ariz.	23,000	10	563,500	Apr. '12	3.00
United Verde, c.	Ariz.	300,000	10	30,097,000	Apr. '12	0.75
Utah, s.l.	Utah.	100,000	10	325,000	Dec. '10	0.02
Utah, c.	Utah.	1,562,599	10	12,694,759	Mar. '12	0.75
Utah Con., c.	Utah.	300,000	5	7,200,000	May '12	0.50
Valley View, g.	Colo.	1,000,000	1	240,000	Dec. '10	0.04
Victoria, g.s.l.	Utah.	250,000	1	207,500	Mar. '10	0.04
Vindicator Con., g.	Colo.	1,500,000	1	2,497,500	Apr. '12	0.03
Wasp No. 2, g.	S. D.	447,900	1	311,966	May '12	0.02
Wolverine, c.	Mich.	60,000	25	7,140,000	Apr. '12	5.00
Work, g.	Colo.	1,500,000	1	172,500	July '08	0.00½
Yak, s.l.	Colo.	1,000,000	1	1,417,685	Oct. '10	0.04
Yankee Con., g.s.	Utah.	1,000,000	1	182,500	July '07	0.01½
Yellow Aster, g.	Cal.	100,000	10	1,081,789	Jan. '12	0.05
Yukon Gold, g.	Alas.	3,500,000	5	3,685,000	Mar. '12	0.07½

Coal, Iron, Industrial and Holding Companies

Amalgamated, c.	Mont.	1,538,879	$100	$68,195,961	May '12	$1.00
Am. Sm. & Ref., com.	U. S.	500,000	100	21,833,333	Mar. '12	0.66⅔
Am. Sm. & Ref., pf.	U. S.	500,000	100	40,333,333	Mar. '12	1.16⅔
Am. Smelters, pf. A	U. S.	170,000	100	6,600,000	Apr. '12	1.50
Am. Smelters, pf. B	U. S.	300,000	100	9,857,000	Apr. '12	1.25
American Coal.	Md.	50,000	25	2,759,687	Mar. '12	0.75
Cambria Steel.	Penn.	900,000	50	15,085,000	May '12	0.62½
Central C. & C., com.	Mo.	51,250	100	3,482,500	Apr. '12	1.50
Central C. & C., pf.	Mo.	18,750	100	1,690,933	Apr. '12	1.25
Consolidation Coal.	Md.	190,247	100	20,233,746	Apr. '12	1.50
Greene Cananea.	U. S.	2,471,314	25	618,828	Mar. '12	0.25
Guggenheim, Expl.	U. S.	207,933	100	13,650,320	Apr. '12	2.50
Inter'l Nickel, com.	U. S.	115,826	100	4,847,942	Mar. '12	5.00
Inter'l Nickel, pfd.	U. S.	89,126	100	3,475,811	May '12	1.50
Inter'l Sm & Ref.	U. S.	100,000	100	2,100,000	Mar. '12	2.00
Lehigh Coal & Nav.	Penn.	482,956	50	21,569,220	May '12	1.00
National Lead, com.	N. Y.	206,554	100	6,711,822	Mar. '12	0.75
National Lead, pf.	N. Y.	243,676	100	24,576,899	Mar. '12	1.75
Old Dominion, c.	Ariz.	293,245	25	2,553,490	Apr. '12	0.75
Phelps, Dodge & Co.	U. S.	450,000	100	17,309,304	Mar. '12	2.50
Pittsburgh Coal, pf.	Penn.	297,010	100	14,766,321	Apr. '12	1.25
Texas & Pacific Coal.	Texas.	25,000	100	2,007,530	Mar. '12	1.50
U. S. Steel Corp., com.	U. S.	5,083,025	100	156,281,164	Mar. '12	1.25
U. S. Steel Corp., pf.	U. S.	3,602,811	100	307,244,144	May '12	1.75
U. S. S., R. & M., com.	U.S.-Mex.	486,320	50	4,079,986	Apr. '12	0.00
U. S. Sm., R. & M., pf.	U.S.-Mec.	351,105	50	10,412,045	Apr. '12	0.87½

Canadian, Mexican and Central American Companies

Ajuchitlan, g.s.	Mex.	50,000	$ 5	$ 185,000	Apr. '12	$0.25
Amparo, g.s.	Mex.	2,000,000	1	800,000	May '12	0.05
B. C. Copper.	B. C.	591,709	5	349,130	June '11	0.12½
Beaver Con., s.	Ont.	1,996,490	1	229,912	Apr. '12	0.03
Buffalo, s.	Ont.	1,000,000	1	1,400,000	May '12	0.03
Cobalt Townsite, s.	Ont.	1,000,000	1	50,000	Feb. '12	0.05
Coniagas, s.	Ont.	800,000	5	3,440,000	May '12	0.30
Crown Reserve, s.	Ont.	1,768,814	1	3,979,833	May '12	0.05
Crow's Nest Pass C. Co.	B. C.	248,506	25	2,182,864	Mar. '11	0.25
Dominion Coal, com.	N. S.	150,000	100	4,650,000	Apr. '11	1.00
Dominion Coal, pf.	N. S.	50,000	100	4,565,000	Feb. '12	3.50
Dos Estrellas, g.s.	Mex.	300,000	0.50	6,780,000	Jan. '11	2.50
El Oro, g.s.	Mex.	1,147,500	4.85	8,295,564	Dec. '11	0.36
Esperanza, s.g.	Mex.	455,000	4.85	10,669,280	Jan. '12	0.36
Granby, s.l.c.	B. C.	148,496	100	4,197,111	Dec. '10	1.00
Greene Con., c.	Mex.	1,000,000	10	6,794,400	Mar. '12	0.60
Guanajuato D., pf., s.	Mex.	10,000	1000	274,356	Jan. '11	3.00
Hedley Gold.	B. C.	120,000	10	564,000	Mar. '12	0.50
Kerr Lake s.	Ont.	600,000	5	3,870,000	Mar. '12	0.25
La Rose Con., s.	Ont.	1,498,407	5	2,764,523	Apr. '12	0.12½
Le Roi No. 2, g.	B. C.	120,000	24.36	1,399,680	Aug. '11	0.48
Lucky Tiger Com., g.	Mex.	715,337	10	1,498,622	Apr. '12	0.20
McK.-Dar. Sav. s.	Ont.	2,247,692	1	2,382,551	Apr. '12	0.10
Mines Co. of Am. (new).	Mex.	1,700,000	10	*877,500	Jan. '12	0.15
N. Y. & Hond. Ros.	C. A.	150,000	10	3,082,500	Mar. '12	0.15
Nipissing, s.	Ont.	1,200,000	5	8,190,000	Apr. '12	0.37½
Peñoles, s.l.g.	Mex.	80,000	25	5,611,688	Mar. '12	1.25
Peregrina M. & M., pf.	Mex.	10,000	100	328,656	Sept. '10	3.50
Pinguico, pf., s.	Mex.	20,000	100	600,000	Oct. '11	3.00
Right of Way Mn's'ts.	Ont.	1,685,500	1	202,260	Dec. '11	0.02
Rio Plata, s.	Mex.	373,437	5	354,990	Mar. '12	0.10
San Rafael, g.s.	Mex.	2,400	25	1,437,624	Jan. '12	2.00
San Toy, g.s.	Mex.	6,000,000	1	360,000	Dec. '11	0.10
Sopresa, g.s.	Mex.	19,200	20	1,517,438	Jan. '11	34.00
Stand'd Silver-Lead.	B. C.	2,000,000	1	75,000	May '12	0.02½
Temiskaming, s.	Ont.	2,500,000	1	1,084,155	Apr. '12	0.03
Tem. & Hud. Bay, s.	Ont.	7,761	1	1,567,722	Mar. '12	3.00
Trethewey, s.	Ont.	1,000,000	1	761,998	July '11	0.10
Wettlaufer-Lorrain, s.	Ont.	1,416,590	1	354,147	Apr. '12	0.05

*Previous to reorganization, $5,258,881.

†Previous to January, 1910, $324,644.

INDUSTRIALS

After June 1, the Dorr Cyanide Machinery Co. offices will be located at 733–5 First National Bank Blg., Denver, Colo.

An office will be continued at 99 John Street, and a private telephone wire will be operated between New York and Ansonia.

Hereafter the offices of Ricketts & Banks, Mining, Metallurgical and Chemical Engineers, will be located at 80 Maiden Lane Blg., New York.

The main office of the A. S. Cameron Steam Pump Works is now at 11 Broadway, New York. The factory has been moved from New York City.

The post cards are actual photographs and are remarkably clear and fine in detail. They are sent out by the Western Electric Co., of 463 West St., New York.

Ray D. Lillibridge Incorporated specialists in technical advertising, announce the removal of their offices to suite 2109-10-11-12 Trinity Building, 111 Broadway, New York.

The Weber Chimney Co. announces that their increased volume of business has necessitated moving their offices to more spacious quarters. They are now at 1452-56 Monadnock Block, Chicago, Ill.

The Bucyrus Co., of So. Milwaukee, Wisc., announces the opening of a Southern office in Birmingham, Ala. It is to be in charge of E. L. Byron, formerly Eastern Sales Manager of the Vulcan Steam Shovel Co.

Officers elected for the ensuing year are as follows: President, Geo. T Smith; Vice President, W. H. Corbin; Treasurer, Geo. E. Long; Secretary, Harry Dailey; Assistant Treasurer and Assistant Secretary, J. H. Schermerhorn.

The Alberger Pump Company has been awarded a contract by the Isthmian Canal Commission covering 145 pumps. These pumps are to be used in the miter gates at Gatun, Miraflores and Pedro Miguel Locks of the Panama Canal.

The International High Speed Steel Company has moved its office and warehouse from the Fox Building, Franklin Square, to 478 Pearl street, New York, where a much larger stock of Bulldog steel will be carried, in all sizes and sections, solid and hollow.

The corporations heretofore known as the Alberger Condenser Co., Alberger Pump Co., Newburgh Ice Machine and Engine Co., have been consolidated under one management in a new corporation known as the Alberger Pump and Condenser Co., with offices at 140 Cedar St., New York.

The main office of The Ansonia Brass & Copper Branch, of the American Brass Company has been removed from 99 John Street, New York, to Ansonia, Conn. This change is made in order to facilitate business and to bring customers into closer touch with the manufacturing departments.

The Lodwic Concentrator Co. of Los Angeles, Calif., has moved into its new factory at the corner of Avenue 20 and the Salt Lake Railroad; having 22,000 sq. ft. of floor space equipped with the machinery necessary for the manufacture of the Lodwic Concentrator and the Isbell Slime Separator.

Mr. M. M. Brown, long experienced and well known in the manufacturing of Wood Pipe, is at the head of a new company which has opened a completely equipped factory which is now turning out Wood Pipe at Williamsport, Pa. The new firm is styled Standard Wood Pipe Co. with M. M. Brown, President and Active Manager.

The Oliver Continuous Filter Company, 503 Market St., San Francisco, Cal., has more than six carloads of filters in its warehouses packed ready for shipment to Mexico. In addition to the machinery in their warehouses the Oliver Company has one carload of filters detained at El Paso, awaiting until the railway embargo is raised.

The Calumet & Hecla Mining Co. of Michigan, are installing sixty-four 8 ft. diameter Hardinge conical pebble mills in their new plant at Lake Linden. These mills will be used for the regrinding of the tailings previously dumped into Lake Linden. They are manufactured by the Hardinge Conical Mill Co., of 50 Church St., New York.

At the annual meeting of the stockholders of the Joseph Dixon Crucible Company held at the Company's main office in Jersey City, N. J., the retiring Board of Directors consisting of Geo. T. Smith, William Murray, Edward L. Young, William H. Corbin, Geo. E. Long, William G. Bumsted and Harry Dailey was unanimously reelected.

An excellent map of the Cuyuna Iron Range (in Central Minn.) has just been published by F. A. Glass, a mining engineer of Brainerd, Minn. Mr. Glass has been in this district for five years and was for some time the chief engineer of the largest operating company. He has been engaged in a general engineering practice for the past two years.

The Abendroth and Root Manufacturing Company, with general sales offices at 50 Church Street, New York City, announce the appointment of the Mexican Steel Products and Machinery Company, 208 Mutual Building, Mexico City, as general agents for the Company in Mexico, handling the complete line of Root Water Tube Boilers, Root Spiral Riveted Pipe, and Hydraulic Mining Machinery.

The executive offices and New York show rooms of the H. W. Johns-Manville Co., manufacturers of Asbestos, Magnesia and Electrical Supplies, have been moved to the new tewlve-story "H. W. Johns-Manville Building," Madison Avenue and 41st Street, New York City, from their old quarters at 100 William St., where they have been located for the past 15 years.

The Crocker-Wheeler Co. of Ampere, N. J., announce that their business is increasing so rapidly on the Pacific Coast that Mr. J. E. Fries has been transferred to the San Francisco Office as Pacific Coast Engineer. With this addition to the present organization, prompter service can be given to current inquiries. On April 1, the company opened an office in the Title Insurance Building in Los Angeles, Cal.

The Hess Flume Company have just completed their new plant at 2166–76 15th Street, Denver, Colorado. This factory will enable the above company to turn out orders for the manufacture of the Hess smooth interior flumes, head gates, pressure pipe, metal substructures, metal intakes and outlets, drops, self-registering water meters, etc., on very short notice. The Hess Flume Company now have both Eastern and Western factories, the Eastern plant being at Canton, Ohio.

The Delaware, Lackawanna & Western Railroad Company has placed an order with the Westinghouse Electric and Manufacturing Company of East Pittsburg, Pa., for its Nanticoke Power Plant at Plymouth, Pa., covering one twelve panel marble switchboard. The board is to control 2 4000 kw. normal rating, 6600 kw. maximum rating, 4400-volt, 3-phase, 60-cycle turbo generators; 8 2000 kw., 3-phase, 4400-volt feeders and provision to be made for two future turbo generators of the same rating as those mentioned above.

The present generating system consists of 5 500 kw. turbo generators.

The switchboard is particularly interesting in view of the application of a modification of the well-known Westinghouse type E oil circuit-breakers which in this installation are arranged for wall mounting on pipe frame-work supports; in other words no cell structures will be required, thus making the whole a very compact and neat installation.

The Terry Steam Turbine Co. have recently put on the market several new types of turbines. One of these is the Terry turbine-driven 3-bearing generator set made in sizes up to 25 kw. Another is the Type D turbine for pumps, blowers, or generators, made in powers up to 600 h.p. and running up to 1800 r.p.m. The third is the vertical type made in powers up to 125 h.p. The smaller sizes, Type ZVC, range in powers up to 25 to 30 h.p. and from there up to 125 h.p., the type BVC applies. This line is designed for driving pumps and centrifugals.

A series of intimate views of the Hawthorne works of the Western Electric Company has recently been arranged for post card use and is intended to give the company's friends a better idea of what the "Electrical Capital of America" really is and what is being done there, industrially and socially. The series consists of twelve views showing a general view of the works, the imposing water tower, the telephone apparatus shops, the general merchandise warehouse, the interior of the lead press room in the cable plant, a view showing how cable cores are built up, a corner of the switchboard wiring department, the cord department, an electric motor truck in the warehouse, the brass band which makes good music as well as "quality apparatus," the lunch room with a seating capacity of 3000 and one of the annual field day events of the athletic association.

TRADE CATALOGS

Taylor Iron & Steel Co., High Bridge, N. J. Bulletin 114. Illustrated, 4 pp.

The Lunkenheimer Co., Cincinnati, O. Annual Catalog. Illustrated, 754 pp. 4x6¼

National Tube Co., Pittsburgh, Pa. Bulletin 9. Unions. Illustrated, 8 pp., 8½x11 in.

Brown Hoisting Machinery Co., Cleveland, Ohio. Booklet J. Illustrated, 42 pp., 6x9 in.

Mine & Smelter Supply Co., 42 Broadway, New York. Catalog 24. Illustrated, 595 pp.

The Goulds Mfg. Co., Seneca Falls, N. Y. Bulletin 112. Pumps. Illustrated, 16 pp., 8x10 in.

Crocker-Wheeler Co., Ampere, N. J. Bulletin 141. A. C. Motors. Illustrated, 16 pp , 7½x10 in.

Manhattan Drilling Co., 25 Broad St., New York. Catalog 51. Dobbins Core Drills. Illustrated.

Carnegie Steel Co., Pittsburgh, Pa. Booklet. Structural Beams. Illustrated, 14 pp., 5x7½ in.

Lagonda Mfg. Co., Springfield, O. Pamphlet. Lagonda Air Cleaner. Illustrated, 4 pp., 6x9 in.

The Hayward Co., 50 Church St., New York. Catalog 39. Buckets. Illustrated, 40 pp., 6x9 in.

Sturtevant Mill Co., Boston, Mass. Booklet. Sturtevant Crushers. Illustrated, 16 pp., 3½x6½ in.

E. T. Copeland Company, 100 William St., New York. Booklet, Scotch Boilers. Illustrated, 24 pp., 6½x9½ in.

Chicago Pneumatic Tool Co., Chicago. Booklet, Compressors for air and gas. Illustrated. 12 pp., 3½x6½ in.

Ingersoll-Rand Co., 11 Broadway, New York. Bulletin 7004. Cameron Steam Pumps. Illustrated, 12 pp., 6x9 in.

Akley Brake & Supply Co., 50 Church St., New York. Booklet, Refillable Fuses. Illustrated, 12 pp., 4x6½ in.

General Electric Co., Schenectady, N. Y. Bulletin 4922. Electricity in Metal Mines. Illustrated, 40 pp., 8x10½ in.

H. W. Johns-Manville Co., New York. Monthly publication, "The J-M Roofing Salesman." Illustrated, 8 pp., 6x9 in.

Hyatt Roller Bearing Co., Newark, N. J. "Twelve Progressive Mine Car Wheel Makers," booklet, 6½x3¾ in., illustrated.

Electric Weighing Co., 180 Thirteenth Ave., New York. Bulletin, Electric Conveyor Weighers. Illustrated, 24 pp., 6x9 in.

Sullivan Machinery Co., Chicago, Ill. Booklet 108, Sullivan Machinery for Contractors. Illustrated, 16 pp., 3½x5½ in. Also Bulletin 66-F.

Hyatt Roller Bearing Co., Newark, N. J. Bulletin 604E, Hyatt Roller Bearings Applied to Mine and Industrial Cars. Illustrated, 24 pp., 7x10 in.

McKiernan-Terry Drill Co., 115 Broadway, N. Y. Bulletins, Wizard Rock Drills and Heavy Duty Pile Hammers. Illustrated, 12 and 8 pp., 6x9 in.

Sullivan Lightweight Rock Drill. Illustrated, 12 pp., 6x9 in. Also Bulletin 58-K. Sullivan Duplex Air Compressors. Illustrated, 16 pp., 6x9 in.

Wagner Electric Manufacturing Co., St. Louis, Mo. "See The Comma," booklet, 8 pp., 6½x3½ in. Also calendar from June, 1912, to June, 1913; 11x14 in. illustrated.

Wilfley Table Suit

The United States District Court, of the Southern District of California, Southern Division, decided at Los Angeles on Mar. 5, 1912, that the Wilfley concentrating table as manufactured under the protection of the Wilfley patent (U. S. pat. 590,675) is not anticipated by the Lampert patents (U. S. pat. 533,362 and 641,977). The court also granted a perpetual injunction against all persons claiming or pretending to have any interest in or rights under the Lampert patents.

The number of suits for infringement on the Wilfley patent has been so great that it may be of interest to quote the claims made in the patent papers:

A transversely inclined concentrating table or surface, having a movement imparted thereto, the tendency of which is to advance the material being treated upon its surface longitudinally forward from the head or mechanism end toward the foot or concentrate discharge end of such table or surface, said surface or table being provided with a number or plurality of riffles extending longitudinally a portion of the distance from its head end toward its foot end, said riffles varying in length so that the tips or terminals thereof advance one beyond the other continuously and substantially along a line diagonal to the direction of the movement imparted to such table or surface, from the upper or feed side, to the lower or tailing discharge side thereof, such table or surface having a sufficiently smooth surface or area, located at the extremities of the riffles and adapted to receive the material caught by them as it leaves the riffles, and to subject such material to the side-wash of the wash-water and repeated washings described in the specification of said patent.

The Mine & Smelter Supply Co., manufacturer of the Wilfley table, has published a warning to the effect that the Lodwic Concentrator Co., of Los Angeles, Calif., has claimed protection under the Lampert patents for the table of its manufacture. The claim is made that the Lodwic table embodies the construction defined by the court as being covered by the Wilfley patent.