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## Apache Mining District, New Mexico

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*SYNOPSIS*—Low-grade oxidized copper ore containing little silver is in demand for flux and returns \$4.80 per ton, which yields a profit of \$1.70 per ton. Air drills and motor trucks would probably enable a reduction in working costs of \$1 per ton.

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Seven miles from the Mexican boundary, in the southern part of Grant County, New Mexico, rising from the plains, is a small group of barren hills. The nearest rail-

ward at a slight angle. The contact between the porphyry and limestone has an irregular trend eastward. For 200 or 300 ft. from the contact the limestone is metamorphosed to garnetized limestone. The main workings are in a gulch; a tongue of limestone running north into the porphyry. The limestone along its western contact has been altered to coarse calcite. The calcite zone ranges in width up to 40 ft. It is 500 to 600 ft. long. The ore mined comes from the calcite zone and



APACHE No. 2 MINE IN THE APACHE DISTRICT, NEW MEXICO, SIX MILES FROM HACHITA

road station is Hachita, N. M., on the El Paso & Southwestern R.R., six miles away. The Apache No. 2 mining district covers the southern side of these hills, lying along their base and is at an elevation of 4650 ft. This is 150 ft. above the shipping station for the ores at Hachita and gives a slight down-hill pull, for the freighters.

### GEOLOGY—PORPHYRY-LIMESTONE CONTACT

The main hills consist of porphyry, light greenish gray of rather fine-grained structure, with phenocrysts of quartz and feldspar. More or less alteration has taken place throughout the mass and the hornblende is altered to epidote. This rock is probably related to the numerous quartz monzonite intrusions so widely distributed over the state and probably of early tertiary age.

Lying on the southern side of the hills in the mineral district is an area of bluish limestone dipping south-

ward at a slight angle. The contact between the porphyry and limestone has an irregular trend eastward. For 200 or 300 ft. from the contact the limestone is metamorphosed to garnetized limestone. The main workings are in a gulch; a tongue of limestone running north into the porphyry. The limestone along its western contact has been altered to coarse calcite. The calcite zone ranges in width up to 40 ft. It is 500 to 600 ft. long. The ore mined comes from the calcite zone and

### HISTORY—DISCOVERED IN 1880

The district was discovered in 1880 by Robert Anderson, the present owner of the Apache mine and the only deposit of importance so far developed in the camp. Work has been done by him or by lessees more or less continuously ever since. At first rich hornsilver associated with oxidized lead ores was shipped from the surface, but these changed below the 100-ft. level to low-grade calcite ores carrying copper carbonates. In the early days the ore was hauled to the Southern Pacific R.R. at Separ, 26 miles distant, but the building of the El Paso & Southwestern made Hachita the nearest point.

### CHARACTER OF THE ORE—OXIDIZED COPPER

At first sight the ore appears as if mining it at a profit would be impossible. The entire deposit is oxidized to

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the bottom of the mine, 360 ft. below the surface, and consists of an extremely coarse calcite mass specked with small particles of malachite and occasional veinlets or rather shells of malachite lining vug holes. The ore is low grade and appears leaner to the eye than it really is.

Pseudomorphs of hematite after pyrite occur in the center of calcite crystals which last are often 6 in. in diameter. Sulphides are entirely lacking, the ore being composed of calcite, malachite, azurite, chrysocolla, hematite, limonite, and carrying 2 to 3 oz. silver per ton. An average smelter shipment assayed as follows: Copper, 1.55%; silver, 2 oz.; iron, 9.6%; lime, 41.2%; insoluble, 12.2%. For this ore the smelter paid for the lime, iron, copper and silver after deducting freight and treatment charges a net price of \$4.80 per ton.

#### METHODS OF MINING—OVERHAND, PILLAR AND CHAMBER

The main hoisting shaft is vertical and 300 ft. deep. Hoisting is done with a 25-hp. gasoline hoist and buckets. A crosscut has been driven from the shaft to the calcite zone on the 300-ft. level. Drifts are driven out each way along the oreshoot, raises extending to the stopes above. The ore is mined in large chambers extending to 30 ft. in width and 100 to 150 ft. in length. Pillars of low-grade ore, constituting about 30% of the deposit are left. The ore is mined overhand and drawn out of the raises through a gate into the bucket, which is then trammed to the shaft and hoisted. Drilling is by hand only. The ground is firm and stands without timber and the stopes are held open by the pillars. The mine is dry, making 20 gal. of water per day, which is surface seep. As yet the deepest workings, a winze 60 ft. below the 300-ft. level, has not reached water level.

Mexican miners are employed, wage \$2 per day. The ore is hauled to the railroad at Hachita in wagons at \$1.10 per ton. The ground is good drilling and breaks well. Probably cost of mining at present is about \$2 per ton and with the \$1.10 wagon haul leaves \$1.70 per ton net profit. The smelters desire the ore as it is excellent flux. By the use of air-drill stopers and motor-truck haulage the cost per ton could be reduced to \$1 per ton at least. The deposit is simple to follow, and easy to mine. The tonnage at present indicated above the 300-ft. level is 200,000 tons, half of which should yield shipping ore of the grade given. Recently a crosscut has been driven into the porphyry foot wall from the 200-ft. level, exposing a highly siliceous carbonate ore carrying 3 to 4% copper. This porphyry ore may develop into milling ore below water level.

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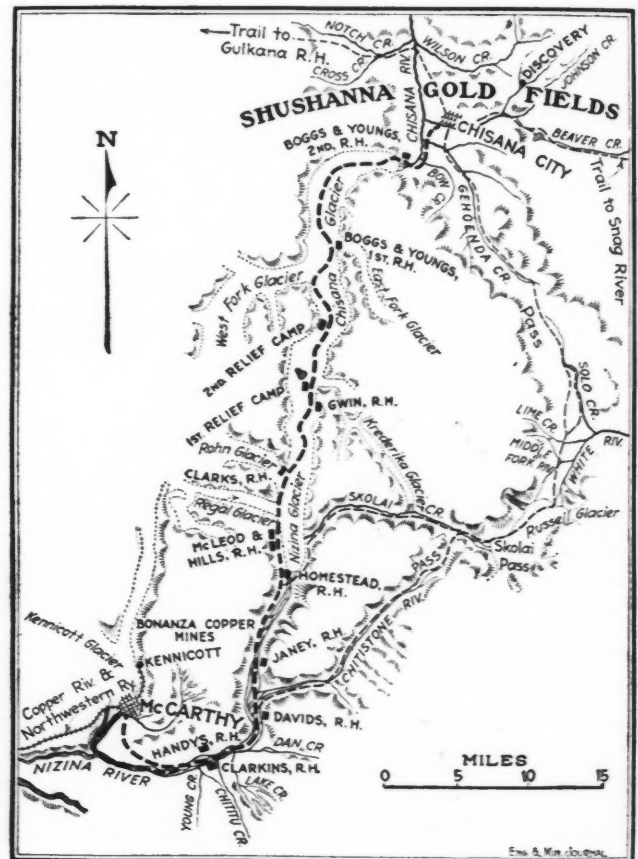
### Mineral Production of Bavaria in 1912

The production of minerals in Bavaria in 1912 is officially reported as follows: Bituminous coal, 790,680 metric tons; lignite, 1,704,654; iron ore, 450,074; zinc and lead ore, 32; pyrites and other sulphur-bearing ores, 6531; rock salt, 1162; graphite, 12,532 metric tons. Productions of sandstone, fireclay, feldspar, chalk, granite, etc., are also reported.

### Outfitting for Chisana

The following notes on outfitting for a trip to the Chisana or Shusanna gold fields in Alaska, and the accompanying map, have been compiled by the Cordova Chamber of Commerce for the guidance of those intending to make the trip. From the suggestions made, many inferences may be drawn of the nature of the country and conditions that will have to be met.

Gold was discovered at Chisana by the James party and Carl Whittam, May 3, 1913. The first news reached the outside world when one of the party arrived at Dawson, June 20, with 250 oz. of dust. It was too late to freight in machinery. The equipment of these people was of the most primitive kind, consisting of a few picks



ROAD HOUSES ON THE CHISANA TRAIL

and shovels, a whip-saw, a hammer and a few pounds of nails, yet with this equipment and a shortage of provisions, they took out \$70,000, as estimated by the last geological reports. Their operations were confined to the shallow gravel on two small creeks. Gold has been found on 12 claims on Bonanza, two claims on Little Eldorado, one claim on Big Eldorado, one claim on Glacier, one claim on Snow Gulch, one claim on Gold Run and on several claims on Johnson and Wilson Creeks.

The deep gravels on the benches have not, as yet, been prospected, but lately 12 Porcupine boilers have gone in over the McCarthy trail and soon the work of prospecting will be begun in earnest. The gold so far found is coarse and lies to bedrock. Bedrock is mostly slate and shale with here and there dikes of porphyry. The bulk of the timber lies along the Chisana River and is from 5 to 8 miles from the producing claims.

Most of the creeks have good grade. Provisions have



fallen from \$1 per lb. to 30c. and 40c. per lb. since the opening of the McCarthy trail, Nov. 25, 1913. These prices will be reduced still further as sledding conditions improve. There are at present from 300 to 400 men and 11 women in the camp. A post office has been established and a contract let for two mails per month. An effort is now on foot to increase this to a weekly service.

Arriving at McCarthy, over the Copper River & Northwestern Ry., the beginning of the trail to Chisana is reached. The trail lies down the Kennecott River to its junction with the Nazina, a distance of five miles, thence up the Nazina River to the glacier, a total distance of 35 miles. This is a water grade, and as much can be pulled as can be piled on a sled. Four- and six-horse teams are used with bob-sleds for the larger outfits and single horses and double-end sleds for the smaller.

From the point where the glacier is reached, the trail has been broken for double-end sleds only, yet there is no reason why bob-sleds and four-horse teams cannot be used if desired. It simply means breaking of the trail for horses abreast instead of single. The trail over the ice is marked by tripods or stakes 8 to 12 ft. long, placed 50 to 200 ft. apart. In going into the diggings, these stakes are kept on the right and in coming out on the left, except where two stand directly opposite each other, in which event the course is between. If this is kept in mind, there will be no necessity of a horse foundering in snow, for the trail has been well packed.

SUPPLIES FOR EIGHT MONTHS AT CHISANA

- |                          |                                 |
|--------------------------|---------------------------------|
| 200 lb. Flour            | 20 lb. Evap. Apples             |
| 25 lb. Corn meal         | 20 lb. Evap. apricots           |
| 50 lb. Graham flour      | 15 lb. Evap. figs               |
| 25 lb. Germ meal         | 15 lb. Seeded raisins           |
| 20 lb. Rolled oats       | 30 lb. Coffee                   |
| 40 lb. Rice              | 4 lb. tea                       |
| 40 lb. Bayo beans        | 8 lb. Ground chocolate or cocoa |
| 20 lb. Small white beans | 10 cakes Sweet chocolate        |
| 10 lb. Lima beans        | 2 1/2-lb. cans Pepper           |
| 5 lb. Split peas         | 1 1/2-lb. can Nutmeg            |
| 5 lb. Evap. sweet corn   | 1 1/2-lb. can Mustard           |
| 50 lb. Sliced potatoes   | 12 lb. Baking powder            |
| 5 lb. Evaporated onions  | 2 lb. Baking soda               |
| 100 lb. Bacon            | 10 packages yeast               |
| 50 lb. Ham               | 12 packages Macaroni            |
| 15 lb. Salt pork         | 6 packages Mince meat           |
| 8 cans Corn beef         | 3 lb. Tapioca                   |
| 4 cans Roast beef        | 1 lb. Sago                      |
| 6 cans Clubhouse sausage | 4 lb. Corn starch               |
| 4 cans Ox tongue         | 4 oz. Vanilla                   |
| 3 lb. Pea sausage        | 4 oz. Lemon                     |
| 2 bricks Codfish         | 1 bot. Evaporated vinegar       |
| 10 lb. Lard              | 8 oz. Beef extract              |
| 60 lb. Butter            | 8 cans Evap. eggs               |
| 6 lb. Cheese             | 1 doz. cans Tomatoes            |
| 100 lb. Sugar            | 1 doz. cans Sauer kraut         |
| 10 lb. Brown sugar       | 1 doz. cans Cabbage             |
| 1 gal. Honey             | 30 lb. Salt                     |
| 2 gal. Syrup             | 12 bars Naptha soap             |
| 6 cans Jams and jellies  | 6 bars Tar soap                 |
| 1 case Eagle milk        | 3 bars Ivory soap               |
| 1 case Cream             | 10 blocks Matches               |
| 25 lb. Evap. prunes      | 1 box Candles                   |
| 1 1/2-lb. can Cinnamon   | 1 kit Sweet pickles             |
| 20 lb. Evap. Peaches     | 2 bot. Worcester sauce          |

CORDOVA TO CHISANA VIA MCCARTHY

	Miles		Miles
Cordova to McCarthy by rail	191	McCarthy to Gwin, R.H.	46
McCarthy to Handys, R.H.	10	McCarthy to First Relief Camp	49
McCarthy to Clarkins, R.H.	12	McCarthy to Second Relief Camp	52
McCarthy to Davids, R.H.	18	McCarthy to Boggs & Youngs,	
McCarthy to Janey, R.H.	22	First R.H.	57
McCarthy to Homestead, R.H.	29	McCarthy to Boggs & Youngs,	
McCarthy to McLeod and Hills,		Second R.H.	68
R.H.	32	McCarthy to Chisana	75
McCarthy to Clark, R.H.	41		

A 1200-lb. horse will pull 1500 lb. on a double-end sled from where the ice is reached, for the first 10 miles, or to Clark's roadhouse; from there on, for the next eight miles or to the summit, the same horse can take 1000 lb., and from the summit to Chisana he can pull all that can be piled on the sled and make the trip in one day.

There are 11 roadhouses distributed along the trail from McCarthy to Chisana and two relief tents near the summit of the glacier. Good accommodation is to be had at all of them. Meals run from \$1 to \$2.50. A

great many carry their own camp equipment and in this way are able to live more cheaply. A company is being organized to construct a telephone line from McCarthy to Chisana, thus connecting the camp with the outside world through the United States cable at Cordova. The Government has detailed soldiers from Fort Liscum to patrol the trail for the winter—thus providing the same police protection afforded by the Canadian government.

Those going in to prospect should be provided with provisions for at least eight months. From 3 1/2 to 4 lb. is required per day per man and any of the merchants making a business of outfitting will put up the supplies in proper proportions. The table shows what will be needed for 8 months for one man. It will thus be seen that from 1000 to 1100 lb. of provisions are required for one person.



Transvaal Notes

JOHANNESBURG CORRESPONDENCE

The dividends declared by Transvaal mining companies for 1913 amount to £8,194,096, being nearly £250,000 greater than those of 1912. This has occurred though the tonnage milled has been smaller and is largely due to the end being put to a campaign of lavish capital expenditure on electrical and milling plant for the purpose of lowering working costs. The strike and the stoppage of importation of tropical natives has reduced the working force by 50,000 since June. The strike gained the men the privilege of weekly payments and a reduction of working hours, but caused much unemployment and indirect loss to the industry.

The Jupiter and the Cinderella Deep mines ceased milling through the year. The former, partly to save other more profitable mines from labor shortage and partly because to reap adequate profits for ore of a value of about 17s., lying at a depth of from 3000 to 5000 ft. required an extended scheme of operations for which neither labor nor capital appeared available. I do not think that the engineers of the Rand have received due credit for their achievement in working ores of this low grade at a profit of such depth. The next mine, the Simmer Deep, was milling 50,000 tons per month of ore returning only 16s. per ton at a profit of about 2s. per ton, and costs could be reduced, were more laborers available. The Cinderella Deep produced some £1,200,000 with no profit, owing to a foolish attempt to mine at a depth of 4000 ft., with only one shaft and no efficient system of ventilation. The eyes of the mine were finally picked out, and what is practically a new mine has to be developed and a second shaft sunk to the reef.

More attention is being given to health matters. I must confess that further experience has shown me that matters of sanitation during the last two years were in an unsatisfactory state on far more mines than I imagined, the fault lying equally, perhaps, between managers and miners. The government inspectors are now most active and new and stringent relations have become law in an endeavor to reduce the risk of phthisis. The truth remains that no matter how active government inspectors may be, if the workmen of the mines as a body prefer to make large earnings at the neglect of health, and if the mine supervisors are overworked or incompetent, or the manager bent at all risks on reducing costs, health conditions must suffer.

The miners could insist on the mines being reasonably healthy tomorrow, the best the management can do is to make it impossible for a careful man to suffer injury. To tell the truth, the visit of Colonel Gorgas was arranged somewhat as a spectacular and diplomatic move. There is no malaria around Johannesburg. The health problem, both on the surface and underground for both natives and whites, is well understood and some progress has apparently been made in dealing even with the pneumonia scourge.

Sanitation and health matters generally are well organized, and I doubt very much if Colonel Gorgas can make any new suggestions, but I do know that he will, in his report, be forced to testify to the world that much useful work has been done, and apparently he is wanted to aid in introducing the closed-compound system of the Kimberley mines into Johannesburg. This would, no doubt, check the illicit liquor and gold traffics, but I do not believe natives would endure it. The only reason Kimberley is popular is that natives who work in the diamond mines have good chances of obtaining money by finding diamonds, for which they receive rewards, or which they sell illicitly.

The past year shows some small progress in underground work. Another attempt is being made to introduce the hammer drill for general mining work. For some time past the Shaw, the Waugh, the Ingersoll hammer drill and others have been used for box-holing and other work with solid steel, and recently they have been employed in back stoping reefs lying on a steep dip. The failure of the Gordon drill as a stoper and of others made the position of the small piston drill for this work, and of native hammer boys, appear secure for this work and the large piston drill did all development work. Recently, the Leyner drill has been reintroduced by the Ingersoll company for general work and it is said to be doing good work. The Flottman, Atlas and other drill companies have been introducing a valveless hammer drill (mounted or unmounted) which supplies water under pressure to the bottom of the hole while it is being drilled, through a very small hole in the side of the drill supplied with water from a collar faced with leather or rubber to prevent leakage. These drills have been working with some success in the New Unified and other mines and should replace quite a number of natives at hammer work as they drill about six 3½-ft. holes per shift.

The policy of amalgamating mines nearing the end of their life to larger concerns is being continued. The Crown mine is to absorb the famous Robinson mine and the New Kleinfontein mine is to absorb the Apex mine and the ill fated Benoni Consolidated, which was ruined by experiments in metallurgy. The new mines which started crushing last year are doing well. The Consolidated Langlaagte is making profits of £22,000 per month and the Van Ryn Deep profit has reached £27,000 and will go higher, as last month they developed 50,000 tons of ore of a milling value of 18 dwt. The last 3500 ft. of development in the Modder Deep mine averaged 11 dwt. over 43 inches.

On Jan. 13, a strike suddenly broke out among the railway workers of the Union and several thousand men are out. A general strike of miners and others is anticipated and the government is rushing 50,000 Boer burghers to the Rand and has called out all the defence forces to overawe the strikers. Trains are running, but dyna-

mite outrages have already been attempted and the miners are known to have stolen many hundreds of tons of explosives. The upheaval was generally unexpected, as the depression since the last strike had been severe. It is as yet impossible to judge to what extent the strike may become universal, but so far the railway men of Cape Colony have not been largely affected. The ostensible cause of the strike was resentment at some recent dismissals said to be rendered necessary by trade depression. The leaders have been imprisoned and martial law will shortly be proclaimed.

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### Electric Zinc-Smelting Litigation in Norway

A case which has attracted much attention among zinc interests in and outside of Scandinavia has just been settled by the Norwegian Courts, at Trondhjem. The Norsk Elektrisk Metalindustri is the possessor of one of Dr. de Laval's patents for the continuous distillation of zinc in electric smelters. In 1911 the Ilen Smelterverk began also to produce zinc electrically. The Norsk Elektrisk Metalindustri, which say that it alone under its patents has succeeded in producing a marketable zinc, maintained that the Ilen Smelterverk had infringed the patent, and brought an action against the latter. The claim included the payment of all profits hitherto made, compensation for loss involved, and the seizure of the smelting plant for the benefit of the claimants. Having carefully gone into the matter and compared patents, the courts came to the conclusion that the two methods differed so essentially that the defendants could not be adjudged to have infringed the claimant's patent. Nor had the claimant shown proof that the defendants at any earlier date had used a device or process which was covered by the claimants' patent. The verdict was therefore given for the Ilen Smelterverk, costs to neither party.

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### Borax Consolidated

Borax Consolidated, Ltd., which is the dominant factor in the world's borax industry, reports a profit of £361,920 for the year ended Sept. 30, 1913. At the 16th general meeting in London, the acting chairman, Col. J. W. Reid, summarized the company's borax operations as follows:

"At present, in addition to the production from our mines in the United States and in Asia Minor, we are obtaining a large quantity of borate of lime from our Ascotan deposit in Chile but our responsibilities to the refiners in various countries who are associated with us and who rely upon drawing their supplies of raw materials from us, and the progressive demand for borate for refining purposes, render it necessary that we should further increase our sources of production, so that in the event of circumstances arising that would interfere with our output in any one or more places, we may be in a position without delay to obtain the necessary quantity of raw material elsewhere. We have, therefore, considered the advisability of enlarging the output from our Arequipa property in Peru, where we have an enormous amount of borate. Our policy is to produce in each country where we own property, . . . to keep down selling prices to as low a figure as the increasing cost of labor and supplies will permit, and thus to encourage an enlarged use of borax products."



# Work of Berthelot and Thomsen on Thermochemistry

BY H. C. JONES\*

*SYNOPSIS*—Material changes were first studied, rather than the more important energy changes. The meaning of homology. A discussion of exothermic and endothermic reactions, and of thermochemical equilibrium.

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We saw in the first chapter what was meant by intrinsic energy. Whenever a chemical reaction takes place there is a change in the intrinsic energy of one or all of the substances taking part in the reaction. There is nearly always a loss in intrinsic energy in a reaction, and the intrinsic energy that disappears is converted into heat, light, electrical energy, or mechanical energy, i.e., is expended in doing mechanical work. The heat, light, electrical energy, or work obtained from a chemical reaction, comes then from the intrinsic energy of the reacting substances, which disappear.

## MATERIAL CHANGES STUDIED FIRST

Chemists studied first the material changes that take place in chemical reactions and neglected the study of the energy changes. The reason for this is apparent. The material changes are the most obvious and are easiest to study. Further, they wanted the substances produced in the reactions especially for technical or commercial purposes.

In dealing with chemical reactions purely from the material side, we are dealing with them from the relatively superficial and unimportant side. We are dealing purely with the results, and asking no questions as to the cause of reactions, which are, of course, fundamental to the building up of a science of pure or industrial chemistry.

The first to recognize the fundamental importance of the study of the energy changes that takes place in chemical reactions, was the great French chemist, Berthelot. What did Berthelot do and how did he do it?

## WORK OF BERTHELOT

The problem which must first be solved, was to devise a form of calorimeter for measuring the heat set free in reactions, which would be as accurate as possible. To measure quantity of heat is a difficult process because heat is, so to speak, "volatile." It is escaping all the time you are trying to measure it, and there is no real heat insulator. The poorest conductor of electricity, i.e., the best electrical insulator, bears the relation to the best conductor of electricity, of about one to a million or ten millions. The poorest conductor of heat, as compared with the best conductor, bears the relation of about one to one hundred. There is, then, nothing approaching a perfect heat insulator. There are, however, marked differences in the power of substances to conduct heat, and the poorest heat conductor, or best heat insulator,

is used to surround the weighed amount of water which is to receive the heat as it is set free in the reaction. Knowing the initial and final temperature of the water in the calorimeter, and the specific heat of water, which is nearly always very nearly unity, but which varies slightly with the temperature, we have all the data necessary for calculating the amount of heat set free in the reaction.

## THE CALORIMETER

Such is the general principle of the calorimeter. The water in the form of calorimeter devised by Berthelot was surrounded by a number of insulating layers of air, water, etc., and was incomparably the best form of calorimeter up to that time. In using the calorimeter, a large number of corrections have to be introduced. The water in the calorimeter is radiating heat outward, notwithstanding all of the poor conductors of heat placed around it. The rate at which it loses heat must be determined and the proper correction introduced. The power of the materials in the calorimeter other than water to absorb heat as the temperature of the water is raised, must also be taken into account, so that good calorimetric measurements are not simple to make.

The form of calorimeter, stirrers, etc., used by Berthelot, can be seen by consulting the great work in which his thermochemical results and conclusions were published.<sup>1</sup> A large number of forms of apparatus in which the reactions in question were allowed to take place, were devised by Berthelot, but for these the above named work must be consulted.

In order that the heat that is liberated in a chemical reaction should be measured with even a fair degree of accuracy, it is necessary that the reaction should proceed rapidly to the end. If the reaction drags itself along for any considerable time, so much of the heat set free is lost by radiation that it is impossible to measure it.

Reactions in which the compounds of carbon are involved in general fulfill this condition. They start slowly, proceed with reasonable velocity for a time, and then begin to slow down, and not infrequently appear to stop long before the end of the reaction is reached. The thermochemistry of such reactions could not possibly be studied. The heat is lost by radiation almost as fast as it is set free.

## CALORIMETRIC BOMB

The heat that is liberated in organic reactions is just as important for the industries as that liberated when the more rapidly acting inorganic substances react. We must know the heat that is liberated when carbon, hydrogen and oxygen unite to form the large number of compounds which they do form, in order to determine how rise in temperature will affect the yield of the compound in question as we shall see. Take the problem of

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Note—This is the second of the series of papers by Dr. Jones. The first of this series appeared in the issue of Mar. 14, 1914.

<sup>1</sup>Essai de Mécanique Chimique, Vol. I, page 140.

determining the amount of heat that is liberated when marsh gas or methane,  $\text{CH}_4$ , is formed. Burn 12 grams of carbon (12 = atomic weight of carbon) and four grams of hydrogen (atomic weight of hydrogen = 1) in an excess of oxygen and see how much heat is set free.

Then burn 16 (12 + 4) grams of methane in an excess of oxygen and see how much heat is set free.

In both cases we have carbon dioxide and water formed, and formed in the same quantities. The difference between the amounts of heat set free in the two cases is the amount of heat that was set free when 12 grams of carbon united with four grams of hydrogen to form 16 grams of methane. In a word, we have determined the "heat of formation" of methane.

By exactly similar procedure, we can determine the "heats of formation" of all the compounds of carbon and hydrogen. But the above named difficulty presents itself. Neither free carbon, nor free hydrogen, nor methane, unites with oxygen under ordinary conditions rapidly. The oxidation, or burning of these substances, is a slow process, so slow, that it would be absolutely impossible to measure the heat liberated in the oxidation reaction, and yet these are fundamental reactions both for scientific and industrial chemistry. We must know these thermal changes if we would ever know the effect of temperature on the yield of the compound or compounds resulting from the reaction. There, Berthelot came to the rescue in a most satisfactory manner. Instead of burning the carbon, hydrogen and methane in the above example in the atmospheric air, i.e., in dilute oxygen where the oxidation goes on slowly, he burned these substances in concentrated oxygen. A concentrated gas means, of course, a gas under high pressure. To accomplish this the oxygen must be brought in contact with the substance to be burned under pressure, and for this purpose, a closed apparatus in which the combustion would take place, must be devised.

Berthelot devised a combustion bomb, in which the substance to be burned was placed and oxygen under pressure run in, and the substance ignited electrically. The whole calorimetric bomb was introduced into the water of the calorimeter, and the heat liberated taken up by the water of the calorimeter. Under these conditions the combustions proceeded quickly to the end, and the amounts of heat liberated could be easily and accurately measured. So much for the methods and apparatus used by Berthelot; now as to the results obtained.

#### ALLOTROPY

We will take up first a few results with inorganic substances. A condition of the elements which has long been known, is that of allotropy. A given elementary substance may exist in more than one form. A few examples have long been known. Oxygen and ozone, monoclinic and orthorhombic sulphur are examples in point. It has recently been shown that a large number of the chemical elements can exist in more than one modification or form. This applies not only to selenium, carbon, and the like, which are known in a great number of allotropic modifications, but to a large number of the metals. The work of Cohen, published during the last 10 years in the *Zeitschrift für physikalische Chemie*, has shown that many metals exhibit allotropy, and that the allotropic modifications of any given metal differ widely in their properties. Some of these modifications have useful

properties, and other properties which render them nearly useless. Take tin: The white form is a most useful substance, while the gray modification, obtained from the white by exposing the latter to low temperatures, is well nigh useless. These are, of course, matters of fundamental commercial importance, since tin objects can be rendered worthless by exposing them for a sufficient length of time to low temperatures.

The question arises, what do we mean by allotropy? Berthelot furnishes the answer for the first time. If we burn a gram of a certain kind of carbon in oxygen, there is produced a certain amount of heat. If we burn a gram of the same kind of carbon in ozone, there is produced more heat. The initial and final substances are the same, with the exception of the oxygen and the ozone, and there are very different amounts of heat set free. What conclusion are we forced to draw? That there are different amounts of intrinsic energy in the oxygen and in the ozone, the ozone containing the larger amount.

If we examine the method of preparing ozone from oxygen, it is in perfect accord with the above conclusion. When we spark oxygen, we obtain ozone, and electrical energy as such disappears. Where does it go? It goes to increasing the intrinsic energy of the oxygen and converting it into ozone. How do we obtain oxygen from ozone? We raise the temperature of the ozone when it gives out heat and passes over into oxygen. All of these facts lead to the same conclusion, viz., that ozone differs from oxygen in the amount of intrinsic energy which it contains.

The old, so called explanation of the difference between oxygen and ozone being due to the former containing two atoms of oxygen in the molecule, and the latter three, is not an explanation at all, indeed, as far as explaining any difference except in the masses of the two molecules, is hardly more than words.

It has been shown that the relations pointed out between oxygen and ozone hold for allotropic modifications of the elements in general. The real difference between two or more allotropic modifications of any element, is to be found in the different amounts of intrinsic energy contained in them.

#### MEANING OF HOMOLGY IN CARBON CHEMISTRY

Berthelot discovered a relation among carbon compounds which was quite as important as the true explanation which he furnished of allotropy. He showed that when the succeeding members of any homologous series of hydrocarbons were burned, the more complex member liberated more heat than the simpler, and the difference between the heats of combustion of any two succeeding members is a constant. This is shown from the following example, the heat set free being expressed in calories. A small calorie, written "cal.," is the amount of heat required to raise one gram of water  $1^\circ$  C. As this depends slightly upon the temperature of the water, the small calorie is usually defined as the amount of heat required to raise one gram of water from  $19$  to  $20^\circ$ .

The large calorie, written "Cal.," is 1000 small calories, and is the unit in which the following values are expressed:

Compound	Heat Liberated on Combustion, Cal.	Difference, Cal.
Methane, $\text{CH}_4$ .....	212	...
Ethane, $\text{C}_2\text{H}_6$ .....	370	158
Propane, $\text{C}_3\text{H}_8$ .....	529	159
Butane, $\text{C}_4\text{H}_{10}$ .....	687	158



A similar relation was found to hold for the unsaturated hydrocarbons of the ethylene and acetylene series:

Compound	Heat Liberated	Difference,
	in Combustion, Cal.	
Ethylene, C <sub>2</sub> H <sub>4</sub> .....	333	...
Propylene, C <sub>3</sub> H <sub>6</sub> .....	493	160
Butylene, C <sub>4</sub> H <sub>8</sub> .....	651	158
Acetylene, C <sub>2</sub> H <sub>2</sub> .....	310	...
Allylene, C <sub>3</sub> H <sub>4</sub> .....	468	158

Berthelot showed not only that this simple relation holds for the saturated and unsaturated hydrocarbons, but for other homologous series of carbon compounds. Take the methyl alcohol series:

Compound	Heat Liberated	Difference,
	in Combustion, Cal.	
Methyl alcohol, CH <sub>3</sub> O.....	182	...
Ethyl alcohol, C <sub>2</sub> H <sub>5</sub> O.....	340	158
Propyl alcohol, C <sub>3</sub> H <sub>7</sub> O.....	499	159

A similar relation was discovered for the halogen substitution products of the hydrocarbons, thus:

Compound	Heat Liberated	Difference,
	in Combustion, Cal.	
Methylchloride, CH <sub>3</sub> Cl.....	165	...
Ethylchloride, C <sub>2</sub> H <sub>5</sub> Cl.....	322	157
Propylchloride, C <sub>3</sub> H <sub>7</sub> Cl.....	480	158

The importance of this relation is that it shows us the real meaning of "homology" in carbon chemistry. It had long been known that the difference in composition between succeeding numbers of homologous series of compounds was one carbon atom and two hydrogen atoms, CH<sub>2</sub>. This, however, did not explain the differences between the properties of the succeeding members of such a series, at least, no other property than the change in mass.

SIGNIFICANCE OF METHYLENE

We know now that the properties of a compound in general are a function of the energy relations that obtain in that compound, primarily a function of the quantity and intensity of the intrinsic energy in the compound. From the above results, we see that the methylene group, CH<sub>2</sub>, carries with it into the compound a constant amount of intrinsic energy, and this is the explanation of the hitherto not understood regular relations between the succeeding members of an homologous series of carbon compounds. The CH<sub>2</sub> carries into the compound which it enters a constant amount of intrinsic energy, expressed in heat energy by 158 Cal. It is the constant difference in the intrinsic energy of succeeding members of an homologous series of carbon compounds that gives us the constant difference in the properties of these compounds. This showed for the first time the meaning of homology in chemistry, and at the same time the importance of dealing quantitatively with energy relations, if we would ever understand the real meaning of chemical reactions and chemical equilibrium.

As a result of his study of inorganic and organic reactions from the thermochemical standpoint, Berthelot discovered the general principle connection reactions and thermal changes, the fundamental principle of thermochemistry.

LAW OF MAXIMUM HEAT EVOLUTION

Given two elements A and B, they can react in a number of ways; they can form the compound AB; they can form A<sub>2</sub>B; they can form AB<sub>2</sub>; they can form A<sub>2</sub>B<sub>3</sub>; in general, they can form A<sub>x</sub>B<sub>y</sub>. Which compound will they form and what determines the values of x and y?

This is a matter of as much importance to the industries as to pure science.

Before the thermochemical work of Berthelot, there was only one way to answer this question, cut and try, and see which way the reaction would go. This was obviously most unsatisfactory, unscientific and involved an enormous amount of work, yet this empirical method was the only one available.

This is all changed now, due primarily to the discovery by Berthelot of the principle which underlies chemical action. Given several possibilities, that reaction will take place which evolves the largest amount of heat. The discovery of this principle connects quantitatively and for the first time chemical action and thermal change. The heat thus produced in a chemical reaction comes from intrinsic energy, and showed this for the first time. When say that that reaction takes place which evolves the maximum amount of heat, we say that that reaction takes place which reduces the intrinsic energy of the reacting substances to the lowest possible level.

The discovery of this principle of maximum heat evolution shows the connection between chemical action and intrinsic energy, and showed this for the first time. When two or more substances are brought together, whether they will react or not depends primarily upon whether there is a sufficient difference in the intensity or potential of the intrinsic energy in the two systems. If this difference is greater than a certain value, the two or more substances will react. If less than a certain value, no reaction will take place. When the chemical reaction does take place, there is a maximum running down of the intrinsic energies of one or both the systems, and consequently a maximum production of heat energy.

CHEMICAL ACTION AND ELECTRICAL ACTION

Chemical action is thus shown to be strikingly analogous to electrical action. When do we have an electrical action or an electrical reaction? When two bodies are charged to different electrical potentials, and are connected by an electrical conductor, we have a flow of electricity from the body charged to the higher potential to that charged at the lower. The electricity flows from the one body to the other, as such, there being only a slight warming of the conductor connecting the two bodies.

In chemical reaction, we do not have simply a flow of intrinsic energy from the body at the higher to the body at the lower potential of intrinsic energy. We have a disappearance of some of the intrinsic energy as such, heat, light, electricity and work appearing in its place. There is, then, the above analogy, and the above difference between an electrical act and a chemical act. The important relation is that they are both, fundamentally considered, energy changes, and the material change that accompanies the chemical action is a subordinate and secondary act.

It is then obvious that this principle of "maximum work," so called, or better, "maximum-heat evolution," is a fundamental generalization, affecting the chemical industries quite as much as chemical science.

There are some exceptions to the above relations and much, too much in my opinion, has been made of these exceptions. Indeed, the attempt has been made in certain quarters to belittle the generalization as practically worthless, because it was not an absolutely rigid

law of nature. A moment's thought will show that this is unjust and unwise. There are very few rigid laws of nature, to which no exceptions are known. Indeed, the number of such mathematically rigid laws could almost be counted on the fingers of one hand.

It should be stated that in connection with the law of maximum-heat evolution, no one has pointed out and explained the exceptions as thoroughly and satisfactorily as Berthelot himself. Even if there are some reactions which do not go in the direction of maximum-heat evolution, the number of cases that conform to rule is so large as compared with the comparatively few well accounted for exceptions, that the latter are practically negligible.

To discover a generalization that establishes such a fundamental relation, and which comprises so nearly all chemical reactions, is to take an epoch-making step toward converting pure empiricism in chemistry into science. As such, the work of Berthelot will undoubtedly go down in the history of chemistry, both scientific and industrial.

#### EXOTHERMIC AND ENDOTHERMIC REACTIONS

We have spoken thus far of chemical reactions taking place only with the evolution of heat. This is true of chemical reactions in general, and the formation of the heat is the key to the reaction and the cause of it. Rise in temperature in general hinders these reactions, or decomposes the products of such reactions, as we say, following the general principle that rise in temperature opposes the formation of anything formed with evolution of heat. This is a principle of fundamental importance for the chemical industries. Whenever the desired product is formed with the evolution of heat, other things being equal, it should be formed at as low temperature as possible, higher temperatures tending to decompose the very products that are often desired.

#### ENDOTHERMIC REACTIONS

There are, however, chemical reactions which take place without the evolution of any heat energy. Indeed, the reaction proceeds with absorption of heat, and in some cases with the disappearance of a large amount of heat energy. Such cases are well known and many of these were brought out by the work of Berthelot.

The existence of these endothermic reactions is of fundamental importance in connection with the preparation of a large number of chemical compounds. Many compounds are formed only at high temperatures, and are formed in larger and larger quantities the higher the temperature at which the reaction takes place. Thus cyanogen is one of those compounds that is formed with the absorption of heat. Thus, when two carbon atoms unite with two nitrogen atoms and form cyanogen,  $C_2N_2$ , there is used up a large amount of heat. This explains why cyanogen is formed in larger and larger quantity, the higher the temperature at which it is formed, and why cyanogen is so stable at elevated temperatures.

The number of examples of important compounds being formed as the result of endothermic reactions could be largely increased, but the above is sufficient to illustrate the general principle. Rise in temperature in general increases the yield of those compounds formed as the result of endothermic reactions, and tends to diminish the quantity of compounds formed with evolution of

heat. Endothermic reactions are more difficult to explain than exothermic.

This is obviously a matter of the very greatest importance for the chemical industries, where the question is of increasing the yield of the substance in question. We want to know whether to raise or lower the temperature to secure this result. We must first know whether heat is evolved or absorbed when the substance in question is formed. If heat is evolved, the substance should be formed at the lowest possible temperature. If heat is absorbed, as we say, the effect of raising the temperature is to increase the stability of the resulting compound, to increase, therefore, the amount of it that will be produced.

#### THERMOCHEMICAL EQUILIBRIUM

At any given temperature, we may have a certain compound forming and at the same time undergoing decomposition. We would then have an equilibrium between the substance in question and its decomposition products, or the products from which it was formed. The point of fundamental importance for the industries is to shove the equilibrium along in that direction which will increase the quantity of the product desired. It is impossible to know how this can be done until we first know whether the reaction absorbs or evolves heat. If the reaction giving the product desired absorbs heat, is endothermic, then the equilibrium point in general can be moved in the desired direction by raising the temperature. If the reaction in question evolves heat, then the lower the temperature at which the reaction takes place, the better in general the yield of the product desired.

The above are general principles, and like such principles in general, there are modifying conditions or circumstances which may, and frequently do, come into play. These can be detected in special cases only by direct experimentation where those particular cases are involved. The above are the fundamental principles underlying thermochemical equilibrium, and these are the guiding thoughts in all investigations of this kind of equilibrium.

#### WHY CERTAIN TEMPERATURES ARE NECESSARY TO START A REACTION

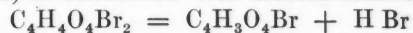
We have seen that two things react chemically when brought together, if the intensities of the intrinsic energy in the two are sufficiently different. The question arises in view of this conception of chemical reaction, why is a certain temperature necessary in order that a given reaction will start? Chemical reaction takes place as the result of an unstable energy condition resulting when two or more things are brought together. A certain degree of instability is necessary in order that we should have a running down of a part of the intrinsic energies of the systems reacting, forming heat or some other kind of energy, and have a rearrangement of the so called matter present in new forms which are more stable.

It frequently occurs that two or more systems brought together at ordinary temperatures do not possess the degree of instability necessary for a chemical reaction. When the temperature is raised, the instability increases and finally reaches a point where it has become sufficiently great to give rise to a chemical reaction, and the consequent arrangement of the systems present. What effect further rise in temperature will have on the reaction, de-



pends primarily upon whether the reaction is exothermic or endothermic.

One of the best examples of the effect of rise in temperature on the velocity of a reaction is that given by Van't Hoff, in connection with dibromsuccinic acid:



By raising the temperature 85°, the velocity of this reaction is increased more than 3000 times.

Oxygen and hydrogen combine so slowly at 350°, that the rate cannot be measured, while at 600° they combine so rapidly that there is an explosion.

One of the most remarkable temperature coefficients of reaction velocity is that of the formation of an ester from an organic acid and an alcohol. Berthelot has shown that for a rise in temperature of 200°, the velocity of this reaction increases about 22,000 times.

#### THOMSEN'S WORK ON THERMOCHEMISTRY

It would not be just to close the discussion of thermochemical principles without referring to the work of Julius Thomsen, formerly of Copenhagen, now dead, on thermochemistry. Thomsen carried out an elaborate investigation in the field of thermochemistry, measuring the amounts of heat set free in a great number of chemical reactions. His results, published in his "Thermochemische Untersuchungen," are the most elaborate that have ever been obtained in this field. The results of Thomsen, taken as a whole, are probably more accurate than those of Berthelot, Thomsen being the "third-decimal" type of mind, rather than a generalizer. Thomsen made careful thermochemical measurements, Berthelot pointed out the meaning of the results obtained.

The most accurate thermochemical measurements that have ever been obtained in the field of carbon chemistry, are probably those of Stohmann, in Leipzig. Stohmann was trained in the school of Berthelot, utilized the experience of Thomsen, and was withal a very careful worker. The results obtained by Stohmann and his assistant, Langbein, are published for the most part in the *Journal für praktische Chemie*.

#### Pyrites in the Urals

The production of pyrites in the Urals has increased decidedly in the last few years. This increase began to be important in the year 1910, says the *Chemical Trade Journal*, Jan. 3, 1914; the output in 1911 was 6,801,921 poods, and increased to 7,569,614 poods in 1912, instead of the two or three million poods formerly registered as the annual production in the Urals. The natural boundary for the distribution of Ural pyrites toward the West and South has hitherto been considered to be the Moscow district, on account of the heavy expense involved in transporting the ore. It is now understood that efforts are being made to place Ural pyrites in the Southern towns of Russia near the Black Sea, Odessa, for example. These transactions were consummated at low prices, and in view of the geographical position of the districts named, great hopes are not expressed of these tentative efforts developing into an important business. It has been calculated that the cost of Ural pyrites at the mine month was 3½ to 6 copecks per pool, (from \$1.10 to \$1.90 per long ton). There is a tendency on the part of the chemical works to establish plants in the vicinity of the mines for the purpose of making acid and various

salts to supply the colonies that are gathering along the line of the Trans-Siberian Ry. It is stated that there is already a market for the pyrites at new sulphuric acid works of the Volga at Kineshma, Kazan, Samara, etc., and that the question of producing superphosphates is to be actively taken up. It is further stated the Kyshtim Corporation has under consideration the production of sulphuric acid or sulphur from the fumes of its smelting plant.

#### Ray Consolidated Copper Co.

The production of copper in concentrates for the fourth quarter of 1913, was 12,369,696 lb., divided into 4,871,566 lb. in October, 4,900,994 lb. in November and 5,232,167 lb. in December. In addition to the copper in concentrates, 243,638 lb. were produced from ore shipped directly to smelting works.

Total ore milled for the quarter was 665,024 tons averaging 1.7152% Cu. This is a daily average of 7229 tons. Average mill recovery was 65.773%. Mill changes and increased tonnage have prevented increased extraction. Expense of changes is included in operation and raises the milling cost, which was 57.739c. per ton for the quarter. Average mining and coarse crushing cost for the quarter was 70.768c. per ton, of which 3.637c. was charged to coarse crushing, leaving 67.131c. for mining.

Underground development was 21,042 ft., making a total to date of 376,972 ft. Average cost per pound of copper, after allowing smelter deductions and applying the earnings of Ray & Gila Valley Railroad as credit to operations, was 9.9801c. This indicates an average cost for the year of 9.8087c., including operating and general charges and 12½c. per ton for mine development extinguishment.

Ray & Gila Valley Railroad shows operating profit for the quarter of \$731,766 and miscellaneous income of \$12,252. Total copper in hand, sold and unsold, at the close of the quarter was 20,413,373 lb., the unsold portion valued at 14c. per lb. Third quarterly dividend was paid in December, amounting to \$543,951, making total dividends paid for the year \$1,631,504. At the time of the report, the daily tonnage milled had reached about 8000 tons.

#### Duty to Provide Safe Appliances

BY A. L. H. STREET\*

A mining company is not bound to furnish the safest appliances obtainable, to prevent injury to its employees, it being sufficient to use an ordinary degree of care to provide reasonably safe tools, etc. Therefore, an employer of a miner was not guilty of actionable negligence in failing to provide flat-faced hammers, instead of round-faced ones, for the breaking of boulders, although the former kind might have avoided the accident to the employee, resulting from a chip flying into his eye, especially since it appears that the employer furnished as safe a hammer as is usually supplied by other mining companies in similar instances. (Springfield, Mo., Court of Appeals, Sager vs. Samson Mining Co., 162 Southwestern Reporter 762.)

\*Attorney, 317 Commercial Bldg., St. Paul, Minn.

# The Treatment of Cyanide Precipitates--II

BY HERBERT A. MEGRAW

**SYNOPSIS**—The combination of blast furnace and cupel is a feature of the Merrill process now used at Homestake. The Goldfield Consolidated also uses it, but with some modifications. Electric smelting has proved successful in particular cases, but cannot be generally considered a competitor. The cost of smelting at various mills is given and a modification of the Monarch-Rockwell single-stage system recommended as advantageous.

Beside the systems already mentioned, there is one of great merit, which has been applied to many mills and which has always succeeded in making a satisfactory showing. By this system, the precipitate is melted so as to put the precious metals into lead bullion, much after the manner of the Taverner process, which has already been described, the difference being that the melting of part of the precipitate is done in a blast furnace, and the balance directly cupeled instead of using a reverberatory furnace. The lead bullion obtained is cupeled in the usual way, and the resulting bullion cast into bars of appropriate size. The method of procedure has been adopted by C. W. Merrill and installed in most of the plants designed by him. The plant at the Homestake, Lead, S. D., is typical of the system and will be described here. Much of the information given has already been published in the paper of Clark and Sharwood, already referred to in this article, but some of it is new and to the point.

## THE MERRILL OR HOMESTAKE SYSTEM

In considering this treatment the diagram, Fig. 8, of the scheme of treatment will be of interest. After acid treatment, which has already been described, the precipitate is partly dried, reducing its moisture content to about 17%, a consistency which avoids dusting and also tends toward forming a sound briquette. The required flux is then added, the ingredients having been previously thoroughly mixed. The homogeneous mixture is then briquetted, each briquette being formed under a pressure of 3500 lb. per sq. in. The briquettes, once made, are dried in a furnace, the details of which are shown in Fig. 9. The presence of some mercury in the precipitate, as in cyaniding of all amalgamation tailings, necessitates a closed drying furnace, but this might not be required in cases where mercury is absent. The fire is maintained sufficiently low so that the pan is not heated to redness directly above the firebox. The briquettes are sufficiently dry, so that they do not spatter when added to the lead bath in the cupel.

The scheme of treatment included the direct cupellation of the briquettes, including the high-grade portion of the precipitate, the lower-grade material, which might make a pasty slag in the cupel, is treated in the blast furnace, together with other materials, as indicated in the diagram.

\*This is the eighth of a second series of articles by Mr. Megraw. It deals with comparative details of cyanide practice, discussing points of possible improvement. Preceding articles of this series appeared in the issues of Sept. 6, Oct. 4, Nov. 1, Nov. 15, Dec. 20, 1913, Jan. 31, and Mar. 7, 1914. The next article will deal with "Ore Classification for Cyanidation," and will appear in the issue of Apr. 25, 1914.

In one particular, however, the diagram represents a previous practice, in that all of the precipitate briquettes are not now cupeled directly.

The cupel is made in a cast-iron frame and consists of a mixture containing 75% of portland cement and 25% limestone, the latter sized between 10- and 30-mesh screens. After using, the test is broken up, the unaltered part thrown away and the remainder, containing litharge

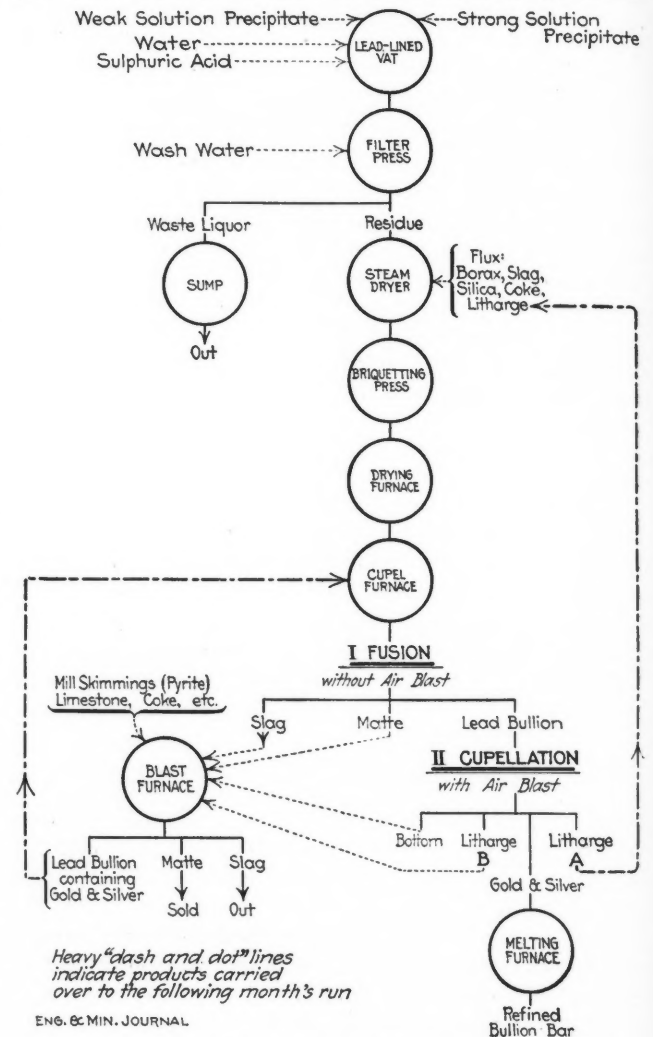


FIG. 8. REFINING SYSTEM AT HOMESTAKE MILL

and buttons of precious metal, put into the blast-furnace charge. Fig. 10 shows the details of the cupeling furnace and the principal tools used in its operation.

In starting the cupeling operation, lead bullion, from a previous run, is melted in the test, and when a good heat is reached, the briquettes are charged through the working door into the bath. When the test is full, a slag car is run under the front and the fireclay wall is cut down allowing slag and matte to flow out into the car. Some lead is usually carried over at the same time, but this is removed when the slag cools sufficiently to be broken up, and is returned to the cupel. The front of the test is then



built up again and the process repeated until all of the precipitate is melted. The fireclay, which contains slag, goes with the byproducts, and the clean part is mixed with fresh clay for future use. More lead is then added, the last of the slag drawn off, and the air blast applied, from the rear across the molten lead. Litharge is drawn off through channels cut in the front of the test. When the litharge is all gone, the heat is increased for a short time, a small dip sample taken, and the fire withdrawn. Just as the metal solidifies, it is broken into pieces of appropriate size for remelting in a crucible.

THE BLAST FURNACE FOR BYPRODUCTS

The blast furnace used for melting down the low-grade precipitate and the byproducts, is an ordinary water-jacketed lead furnace, with a round stack and three tuyeres. It is operated with a lead well and forehearth, cast-iron cones serving for the latter. Each one is retained in service until matte is observed to overflow with

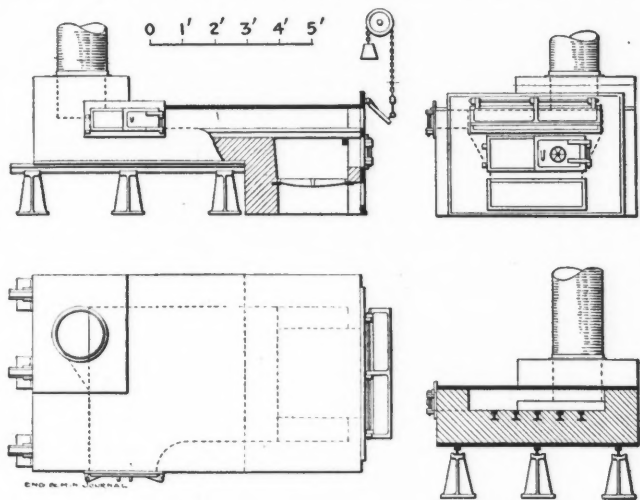


FIG. 9. DRYING FURNACE AT HOMESTAKE

the slag, then it is removed and another cone substituted. When cold, the cone is emptied, the button separated, matte reserved for shipment, and the slag held for the next furnace run, when it is used over again. The slag which overflows the forehearth and runs into pots is rejected.

Copper in the furnace was formerly considered a drawback, and its presence in the litharge and lead decreased fusibility and made cupelation difficult. Satisfactory matting is now obtained through charging the fine particles of pyrite from the cleanup barrels of the stamp mills, which carries gold enough to make its recovery important. To avoid trouble through the fineness of this material, it is mixed to a thick paste with water glass, formed into blocks and dried at low heat. The elimination of fines has made it possible to matte all the copper originating in the cyanide product.

Many variations of the method described have been tried, but this is considered most effective. Direct cupel treatment of the precipitate, without acid treatment, gave results about equal in cost of labor and material to the regular method, but the larger bulk of material and higher melting point were unfavorable factors, while a heavy lead loss in slag offset the saving in acid. Direct fusion of the briquettes in the blast furnace, with or without acid treatment, was tried and finally abandoned on account of the

difficulty with frozen furnace, although this was probably on account of the presence of some slime in the precipitate. With clean precipitate fusion in the blast furnace was readily accomplished without difficulty or loss. It is not followed at the Homestake on account of the difficulty of fitting it in with the equipment and organization. A drawing in detail of the Homestake blast furnace is shown in Fig. 11.

DIRECT BLAST-FURNACE TREATMENT AT GOLDFIELD

Direct blast-furnace smelting of precipitate is practiced at the Goldfield Consolidated mill. The precipitate contains copper, sometimes as much as 40%, but it is satisfactorily handled in the furnace. The mixture consists of precipitate, 100 parts; litharge, 100 to 125 parts; blanket concentrates, 60 to 70 parts; and flue dust and floor sweepings, which reduce the moisture to 9%. The mixture is then briquetted, dried and sent to the blast furnace.

The furnace is about the same as that used at the Homestake, and the lead bullion produced is cupeled in about the same way. The product of the cupel is melted in a Steele-Harvey tilting furnace and molded into bars for export. The bars average 930 fine, about the same, or somewhat less than the Homestake bullion, which runs 980 fine. Figs. 12 and 13 show an outside view and detail drawing of the Goldfield refinery.

It will be seen, upon reference to the drawing, that this refining plant is particularly well designed. The precipitate is cleaned from presses directly into a precipitate car, which is steam-jacketed, and in which the drying is carried out. Flux is added and mixed in the same car, which is then moved to the briquetting machine. Briquettes are received on trays and placed in steam-jacketed drying cars. Everything is then conveniently fed into the blast furnace, thence to the cupel and finally to the Steele-Harvey furnace in which the metal is melted for casting into bars.

The refinery of the Dome mill, at Poreupine, Ont., is shown in Fig. 14. The drawings of the Dome refinery, Homestake cupel furnace and Homestake blast furnace are shown by courtesy of the Merrill Metallurgical Co., by whom they were designed.

ELECTRICITY FOR MELTING SLIME

Up to the present time electricity has not become a popular agent for use in smelting precipitate, but there are examples of some in use which have given remarkably successful results. One operated at the Lluvia de Oro mill, Chihuahua, Mexico, is described in detail by H. R. Conklin<sup>4</sup> in a comprehensive review of the furnace and its characteristics. The electric device has been perfected and is being marketed by the Pittsburgh Electric Furnace Co., which holds patents covering it.

The furnace is started with an arc. It consists of a brick-lined steel shell with a stationary bottom electrode and a movable top one. After the arc is struck, the slag or slag-forming constituents, broken glass or soda, borax and silica in varying proportions, are fed into the furnace. As the slag melts, the electrodes are drawn apart until the desired height of slag is obtained. The furnaces are always worked with a deep slag column, and as a consequence, a high voltage, these two features tending

<sup>4</sup>"Eng. and Min. Journ.," June 15, 1912.

toward a high power factor and close temperature regulation. There is no arc after the first slag is melted, as the upper electrode dips beneath the surface of the melt. The slag column is about half the height of the furnace, and after its formation, the precipitate is fed in and sinks through the slag to the bottom, where it melts, away from the influence of the air.

It is not considered absolutely necessary to dry the precipitate before putting it into the furnace, but it is better to do so to obtain a more rapid melting, and reduce

oz. per ton treated. The losses are apparently regulated by the temperature; the hotter the furnace the less the loss. Fig. 15 shows an installation of the electric furnace as supplied by the manufacturers.

As a convenient and efficient process, in the way of recovery percentage, the electric furnace appeals to the operator, but there are drawbacks which would have to be thoroughly considered before the system could be recommended. It is likely that its cost would be higher than when coke or oil fuels were used in districts where

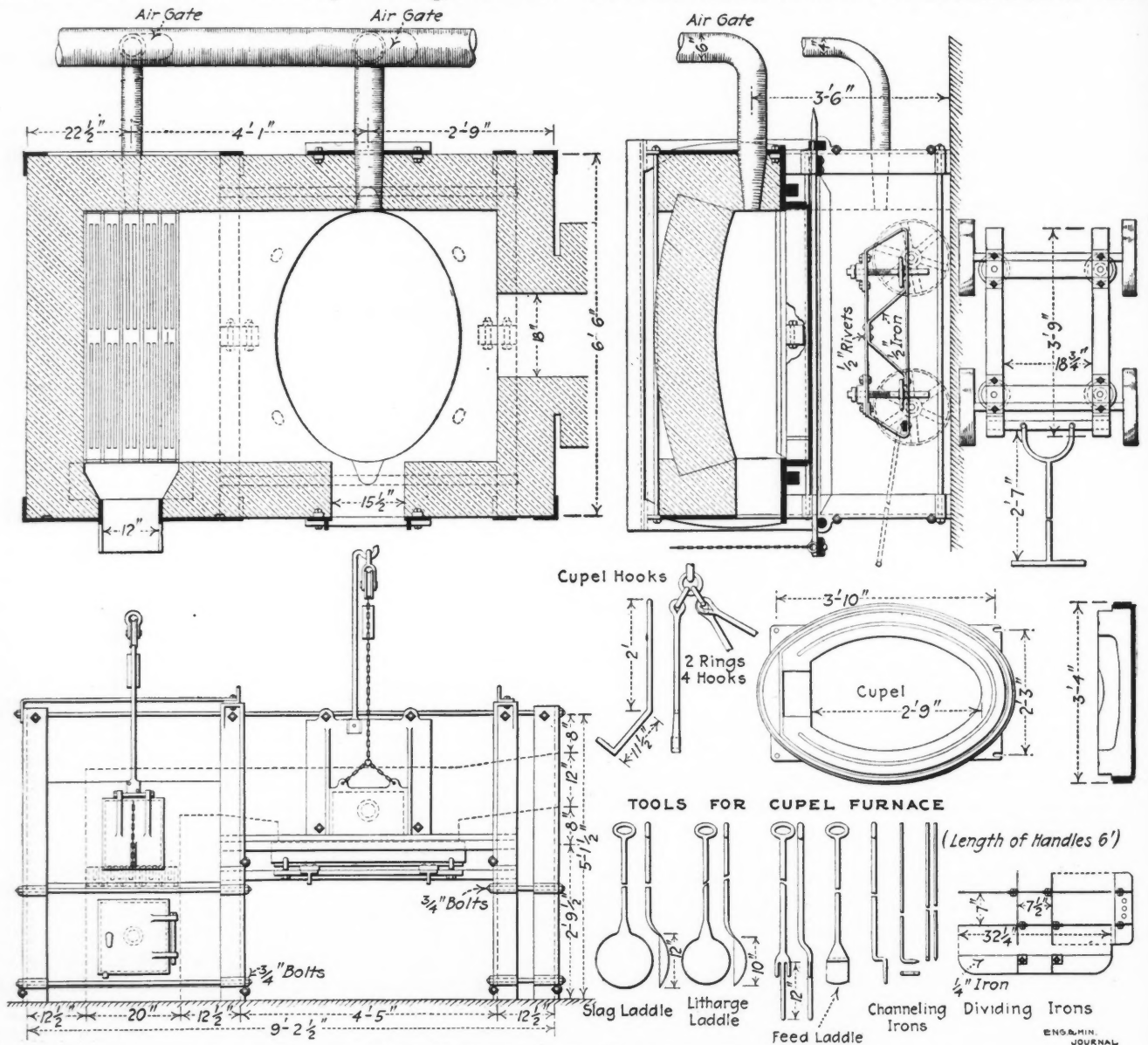


FIG. 10. THE MERRILL CUPEL FURNACE AND ACCESSORIES.

the current consumption. Melting is rapid, and this speed is said to be a factor in the reduction of cost. The power for melting silver precipitate is placed at about 50 kw. per 1000 lb. on short runs, and somewhat less, 50 to 55 kw. on long runs and dry precipitate. The theoretical power for melting silver is placed at 40 kw. per 1000 lb., and for gold, 65 kw. for short runs and 55 to 60 kw. for long runs. The difference between long and short runs is accounted for by the absorption of heat by the furnace.

The average slag loss in silver varies between 1 and 3 oz. for each ton treated, and in gold the loss is about 0.2

the latter are easily available, and refining seems to be out of the question when electricity is used, the process being materially subject to the limitations of electric refining in general. It would be interesting to have complete cost data of established plants.

COST NOT AN INDEX OF EFFICIENCY

The cost of precipitate melting varies so much that it is dangerous to draw too decided conclusions from figures shown by plants in operation, but these figures do indicate the tendency of the several processes followed, and in that



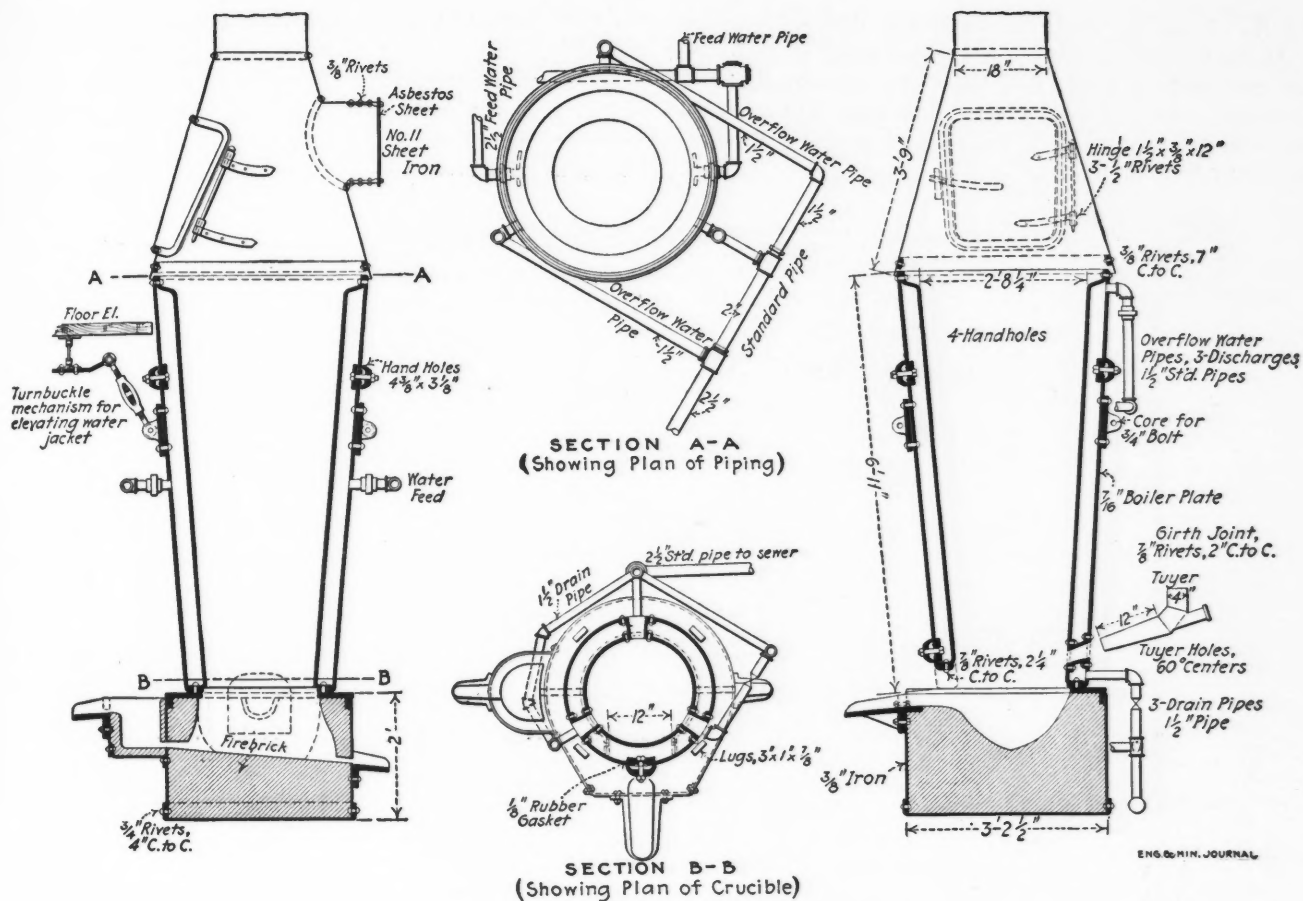


FIG. 11. MERRILL BLAST FURNACE

way are valuable. A consideration of the work of some prominent plants will be of great interest.

At the Homestake mine, the costs of melting and refining are:

MELTING COST AT HOMESTAKE MILL	
Per lb. ppt.	\$0.0889
Per oz. gold	0.0953
Per oz. gold and silver	0.0697*
Per ton sol. precipitated	0.0085
Per ton treated	0.0046

\*This figure, which represents the cost per ounce of doré bullion produced, is the one which is most significant, and possibly the best one to use as a basis of approximate comparison.

At the new Belmont<sup>5</sup> mill, at Tonopah, Nev., the melting of precipitate has received thorough study and the practice evolved seems exceptionally good. The equipment is two Monarch-Rockwell furnaces in which the melting is done in one operation. The cost of installing a lining, which serves for melting 500,000 fine oz. of gold-silver bullion, is \$231.45, the constituents being 25 sacks of carborundum and kaolin, 2550 lb. at \$0.04, \$210; 1/2 bbl. water glass, \$11.45, and labor \$10. On this basis, the lining costs \$0.462 per 1000 oz. melted.

A melt of 105,676 oz. was finished in 36 hr. from the time of lighting the furnaces, with the following cost:

MELTING COST AT BELMONT MILL	
1139 gal. fuel oil, at 3.83c. per gal.	\$43.62
Labor	40.95
Power for blower	6.00
<b>Total</b>	<b>\$90.57</b>

The labor included a head melter, two shifts at \$175 per month, \$11.70; melters, 2 1/2 shifts at \$4.50, \$11.25;

<sup>5</sup>A. H. Jones in "Eng. and Min. Journ.," June 14, 1913.

helpers, 4 1/2 shifts at \$4, \$18; a total of \$40.95. The precipitate is 60% to 80% fine, and is melted without acid treatment, the resulting bullion being more than 900

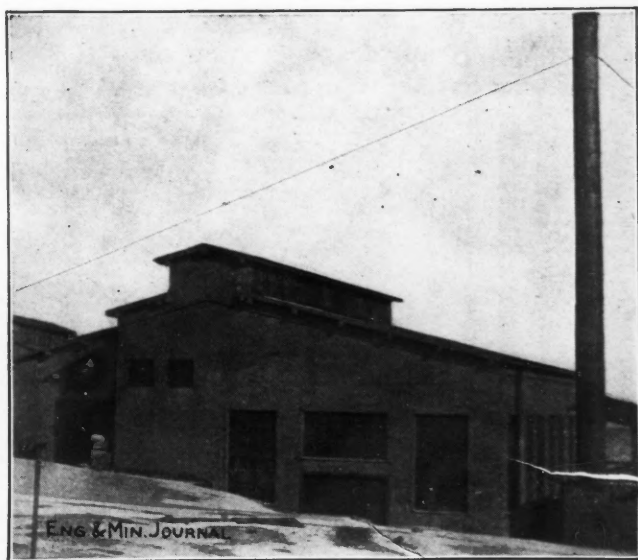


FIG. 12. REFINERY OF GOLDFIELD CONSOLIDATED

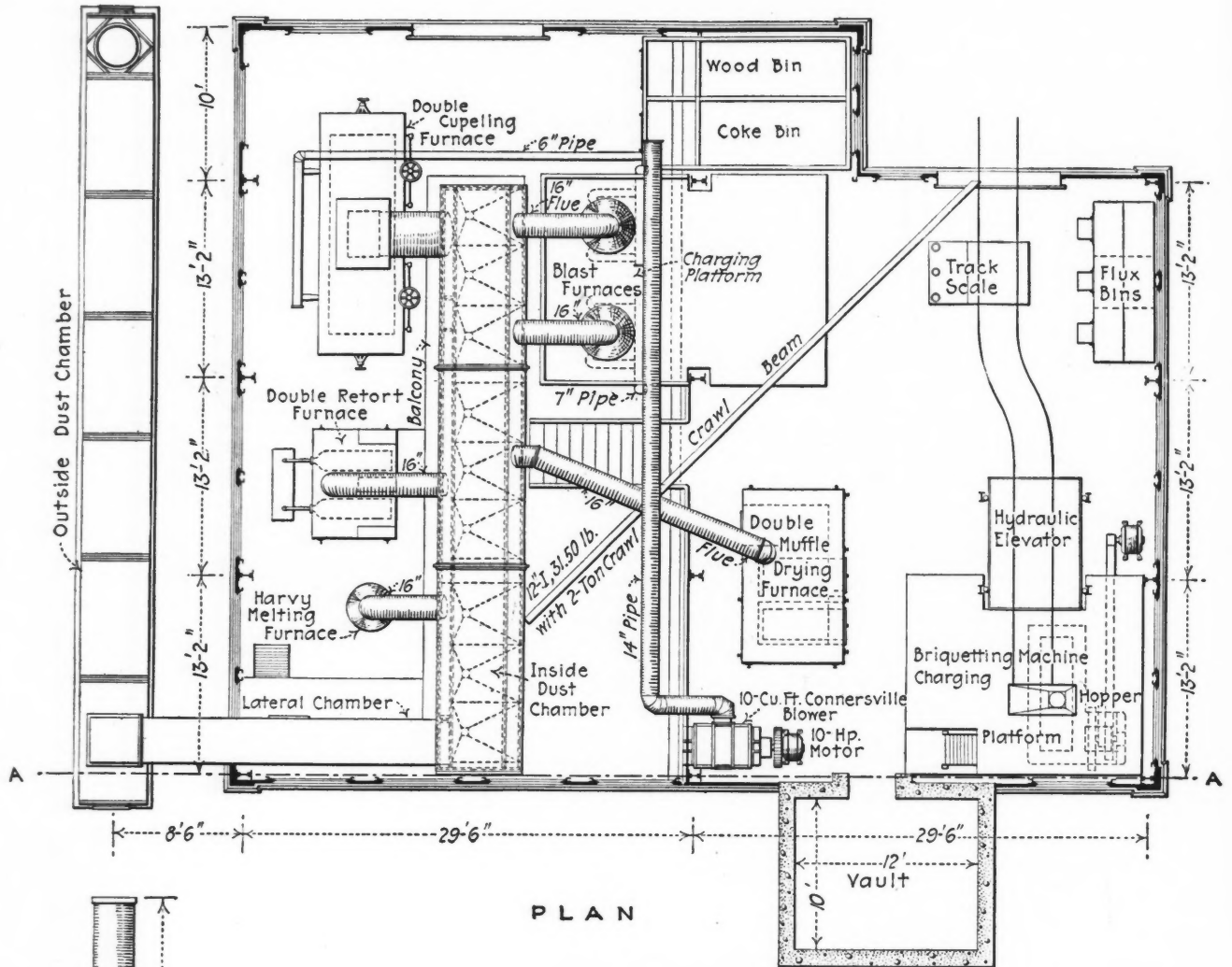
fine. The precipitate is mixed with flux and briquetted before melting.

In cleaning flues, approximately the same results are obtained each time. With 1,749,135 oz. melted, worth \$1,439,225, there was recovered 124 lb. of dust worth \$1

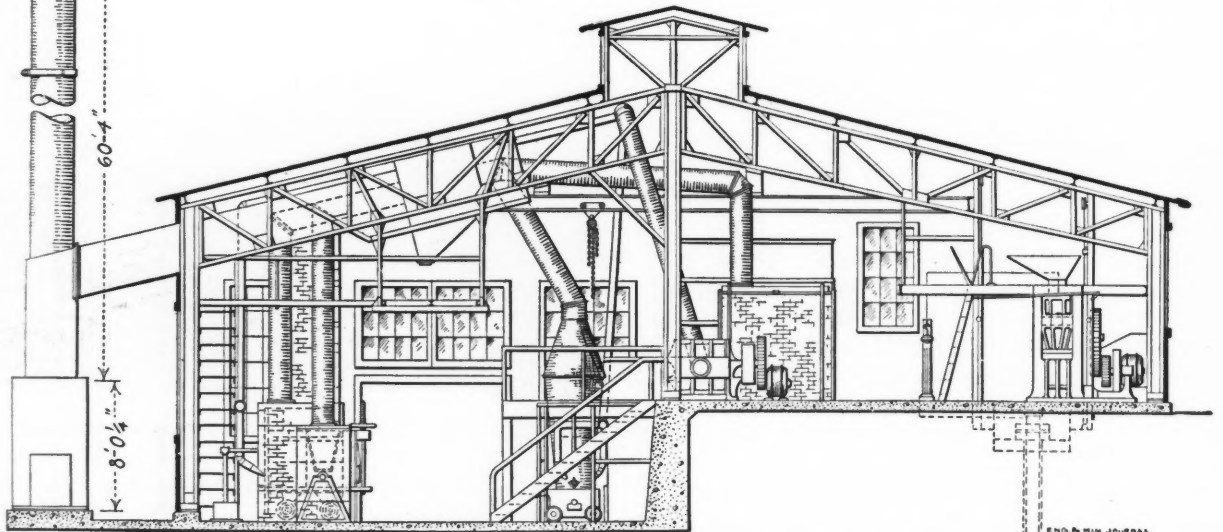
per lb. There is, therefore, little loss through dusting. At the mill of the West End Consolidated, at Tonopah, the precipitate is melted in a Faber du Faur furnace with a special low-pressure burner. The cost tables shown here was obtained in about two tons of precipitate, which ran about 65% bullion.

MELTING COST AT WEST END MILL

	Per oz. bullion
Oil fuel .....	\$0.0008
Flux .....	0.0030
Labor .....	0.0008
Crucibles .....	0.0012
Power and extra material.....	0.0004
<b>Total .....</b>	<b>\$0.0062</b>



PLAN



SECTION A-A

FIG. 13. REFINERY OF GOLDFIELD CONSOLIDATED



At the Mexican mill at Virginia City, Nev., a Monarch (Steele-Harvey) oil-fired tilting furnace is used for melting precipitate, Dixon crucibles being the melting vessel.

COSTS AT MEXICAN MILL

	per oz. bullion
Labor .....	\$0.00108
Fuel, oil .....	0.0003
Crucibles .....	0.00018
Flux .....	0.0003
<b>Total .....</b>	<b>\$0.00186</b>

At the Goldfield Consolidated mill, under the system of precipitate handling already described, the cost was as

gold and contains much greater value for the same weight than the Belmont precipitate, for instance, which is of silver. In the latter case a much greater quantity of

COST OF MELTING AT GOLDFIELD

Based on 10,000 lb. precipitate per month over 12 months.

	Per Ton Ore Treated
Labor .....	\$0.023
Supplies .....	0.032
Power .....	0.000 (not estimable)
<b>Total .....</b>	<b>\$0.055</b>

material is handled, a fact which tends toward lower costs. In the case of the Belmont costs, as given, it is evident

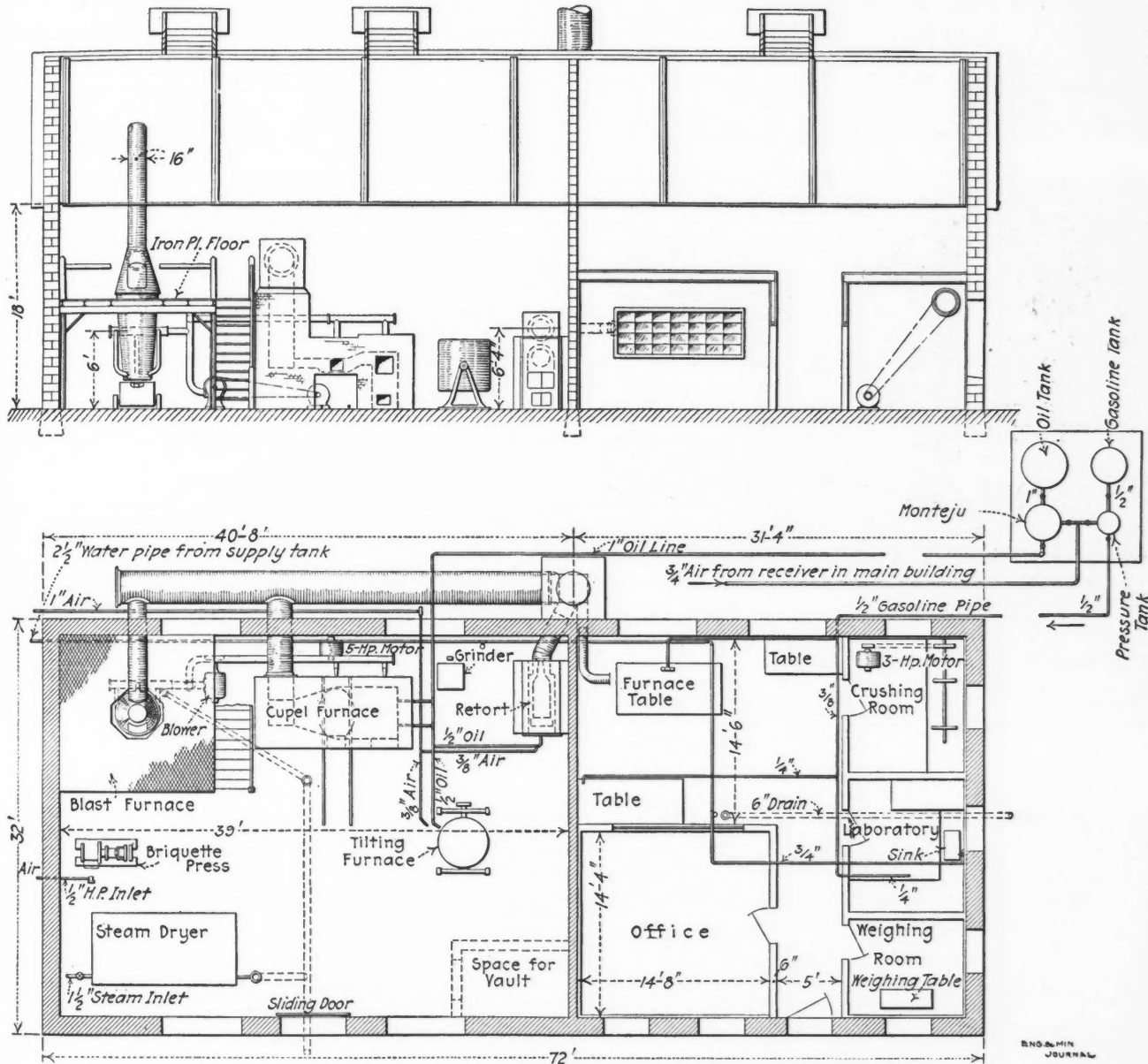


FIG. 14. REFINERY ARRANGEMENT AT THE DOME MILL

shown in the accompany table. This is not given in terms of ounces of fine bullion as are the others previously given, but are in terms of cents per ton of ore treated. In order to make an approximate comparison then, it would be necessary to know the approximate production for the period, 1911 and 1912, when these costs were obtained.

A review of the costs of different systems is not absolutely conclusive on account of the difference of conditions. Thus, at the Homestake mills, the precipitate is

that some items are omitted which are included in the Homestake list, notably fluxing and preparing for the melt, but these details are of minor importance when compared with the main costs. They could not by any means make any great difference in ultimate costs.

ESTIMATION OF VARIOUS PROCESSES

When one considers a refining process from all points, it is evident that crucible melting in stationary furnaces

is the first to be condemned, both on account of its inconvenience and its costs. The tilting furnaces are much better. They impose no great hardship upon the operator and are appropriate for use in the smaller plants, but for the large plant, their costs are too high. In such cases, the available methods are the reverberatory furnace and cupel, blast furnace and cupel, cupel alone and the Monarch-Rockwell direct-melting system. Study and experience in all these systems leads to the conclusion that the Merrill combined blast-furnace and cupel system, and the Monarch-Rockwell direct-melting system represent most advanced practice and are most likely to be efficient. It is, of course, to be understood that there are limitations to both and that each is capable of further development.

The two-chamber Monarch-Rockwell furnace might easily, in my opinion, be developed into, or utilized in a newer system, which would have greater advantages than



FIG. 15. ELECTRIC MELTING FURNACE

any now followed. It appears possible, for example, that zinc might be distilled from precipitate in the same vessel in which it is later melted. When volatilized zinc is suddenly cooled, it is precipitated in the form of dust; spelter is formed by slow cooling. Where zinc dust is used as a precipitant, the recovery of the zinc in the precipitate would be a distinct saving. The zinc could be immediately utilized as further precipitant, and any small quantity of precious metal which might pass over with the zinc would come back immediately in solution and no loss would be incurred. After removing the zinc, the precipitate could then be appropriately fluxed and melted. Skimming is easily accomplished by partly tilting the furnace and drawing the slag. By proper fluxing, as is mentioned in the description of Chrome practice, the metal may be brought to a high degree of fineness, which may be considerably increased by finishing the process with an air blast. This tends toward oxidation of impurities and, properly conducted, eliminates the matte. The metal may then be cast in bar form, as it finally shipped. A one-stage process of this kind is to be desired on account of the small amount of handling, involving labor, which is required, and the comparative ease with which it can be carried out. There is no reason why such a system could not be developed, and it apparently would be distinctly advantageous. I hope that the matter will be given attention by those who have the facilities for experimentation.

## Conveyor System of Magna Mill

The Utah Copper Co. has recently changed the entire system of ore handling at its Magna plant. An extensive system of car handling has been replaced with a set of conveyors furnished by the Stephens-Adamson Mfg. Co.

The ore is brought from the mine in steel hopper cars of 100,000 lb. capacity each. The bins are placed on a hillside and the track leads on a trestle to the top of the bins. The cars are hauled over the bins, a whole train of about 10 cars at a time, and dumped over grizzlies with 3-in. spaces. The mine-run varies from 18-in. pieces down to dust.

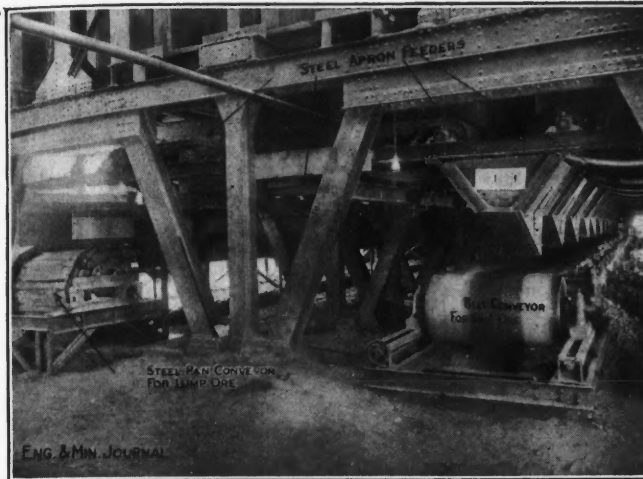
Beneath the coarse-ore bins is arranged a series of four steel-pan conveyors, placed end to end on one line. These run in opposite directions so that the two at either end travel toward each other, delivering together into the same crusher. In handling the ore from the various bins to the conveyors, it was impracticable to attempt to control the flow simply by means of hand-operated gates. The lumps require openings so large that the ore would rush through uncontrolled and flood the conveyor. To meet this difficulty, it was necessary to use some sort of high-capacity automatic feeder to obtain a uniform flow of ore from the bins to the conveyor beneath. The type of feeder selected as best adapted to meet these requirements was the steel apron. Its rugged construction, necessary to support the immense weight of the ore, the relatively small amount of headroom required, and its unusual capacity, were factors considered in its adoption. One hundred of these feeders were necessary under the coarse-ore bins, ranging in size from 30 in. wide with 42-in. centers to 36 in. wide with 72-in. centers. All feeders are driven through ratchet mechanisms, operated by eccentrics on countershafts which, in turn, are geared to the main shafts extending the length of the bins. Each countershaft operates about four feeders. The ratchet drive provides a simple means of control for each feeder. Wires connecting with the ratchet pawls extend to the top of the bins so that the operating mechanism of each feeder may be engaged or disengaged at will.

The pan conveyors handling the lump ore are 48 in. wide with 12-in. pitch. The pans are lined with 4-in. planks which act as cushions to absorb the shock of the heavy ore falling from the feeders. The pan conveyors are of two different lengths to correspond with the position of the gyratory crushers. Two of them are each 108 ft. between centers and the other two are each 123 ft. between centers. As the ore is reduced by each gyratory crusher, it is discharged on a pair of 36-in. belt conveyors, operating at right angles to the pan conveyors and rising on an incline to a position above the fine-ore bins.

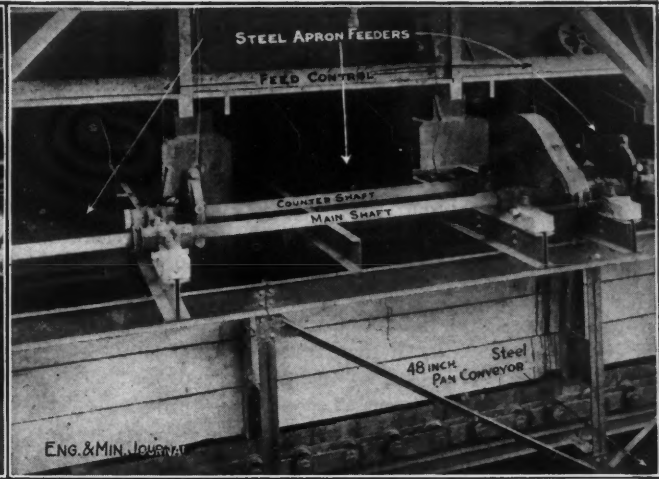
The fine ore which passes through the grizzly bars, as it is delivered from the railroad cars, is withdrawn also by apron feeders and delivered through chutes to 42-in. belt conveyors, extending the length of the bins. Wherever the construction of the bins allowed, the apron feeders were arranged to travel in the direction of the belt, rather than at right angles as is the case of the pan conveyors. Thus, with the assistance of properly designed chutes, the ore is fed to the belt at approximately

Note—An abstract of an article in the "Labor Saver," No. 63.

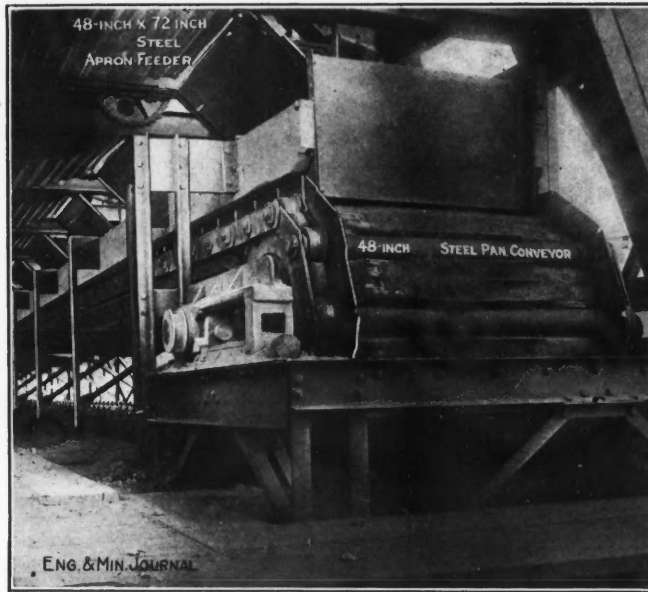




FEEDING SYSTEM TO PAN AND BELT CONVEYORS



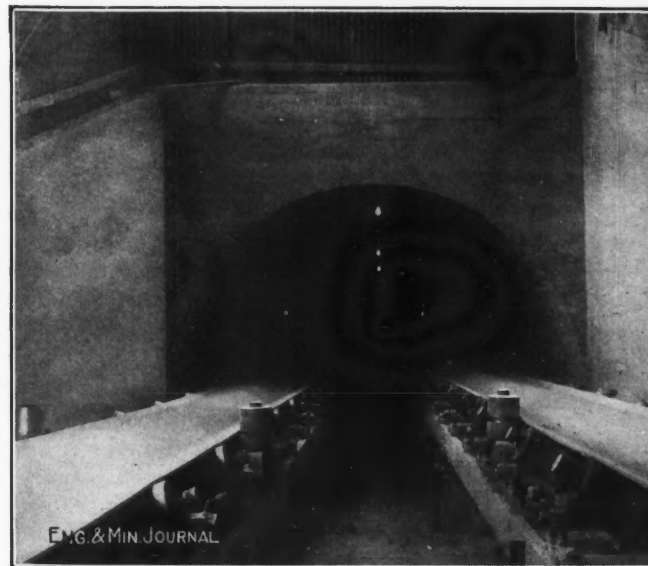
ARRANGEMENT OF DRIVE FOR APRON FEEDERS



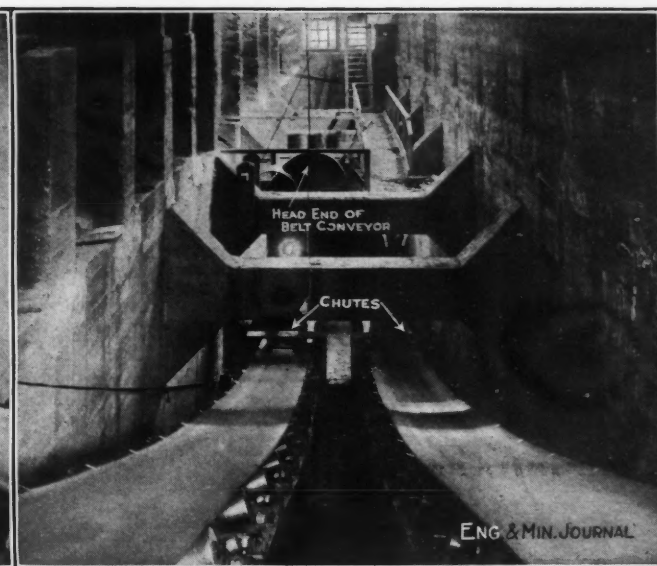
PAN CONVEYORS SHOWING WOOD FILLERS



DISTRIBUTION OF CRUSHED ORE TO BINS BY 42-IN. BELTS



BELT CONVEYORS LEADING FROM ORE BINS



BELT CONVEYORS WHICH RECEIVE DISCHARGE FROM THOSE ON LEFT

the belt speed, eliminating abrasion as far as possible. These belt conveyors deliver centrally to another pair of belt conveyors arranged in duplicate and also leading to a point above the crushed-ore bins. There are thus six conveyors leading up to these bins from the coarse-ore bins. The discharge from each pair of inclined conveyors is received by a 36-in. shuttle-type conveyor and distributed into the bins. The shuttle conveyors consist of reversible belt conveyors carried on traveling carriages which operate back and forth on tracks above the bins.

From these fine-ore bins, the ore is withdrawn again by apron feeders and delivered to belt conveyors, which carry it to the rolls and thence to the concentrator as required.

The entire equipment was designed not only to save the labor of handling by cars, but at the same time to relieve the crushers of the burden of handling the fine ore which formerly clogged and retarded them. This arrangement has so increased the capacity of the coarse-crushing plant that a contemplated extra unit of coarse-crushers was eliminated.

The length of the ore bins and the great quantity of ore to be handled necessitated a vast amount of conveying equipment. The four 48-in. steel-pan conveyors, each with a capacity of 4000 tons per 24 hr., aggregate 462 ft. between centers. A battery of 68 steel-apron feeders, 36 in. by 72 in. feeds the ore to these pan conveyors and a battery of thirty-eight 30x42-in. feeders serves the belt conveyors. The belt conveyors in the crushing plant include approximately 1700 ft. of 30-in. conveyor, 1000 ft. of 36-in. and 230 ft. of 42-in. Style No. 9-D carriers are used for the 30- and 36-in. belts. The 42-in. belts are carried on flat carriers.

It is already recognized that great savings are being made by this system of handling as against the old method of electric locomotives and hand-operated gates. The Utah Copper Co. has also recently redesigned its crushing plant at Arthur, and equipped it with a somewhat similar outfit of Stephens-Adamson conveyors and feeders.

✽

### End of the Rio Tinto Strike

On Jan. 25, 1914, the arbitration board convoked to consider the points of dispute between the company and the Rio Tinto workmen delivered its decision, says the *Mining Journal*. The strike was the outcome of the non-fulfilment by the company of Article 13 of the agreement terminating the November strike, under which the workmen claim that work should be found for all the dismissed men before Jan. 1.

As the company had pointed out that it might be driven to close the works, this attitude led to apprehensions of a definite break. In view of the threatened conflict, the Government felt compelled to interfere, and acted in such a way as to bring about the results that could not have been better for all parties. In the end the company agreed to accept whatever decision the board should make. After several sessions, extending over four days, the board pronounced its decision, the terms of which are as follows: (1) A day shift in the mines will last 8½ hours from the time that workmen receive ticket of admission. (2) All workmen signifying their desire to work in *compañerías* will be placed on this system before April 1 next. (3) The daily shift on the

mining and public railways to be 9½ hours, including crib time. The Government further obtained from the company an undertaking that there would be no reprisals.

As soon as the workmen knew the terms of the decision they manifested great satisfaction, and it must be admitted that the final attitude of the company could not have been more conciliatory. The spirit of the award is no doubt advantageous for the workmen, and on that account a longer period of regular labor may be expected. The Arbitration Board constitutes a new system which, avoiding the asperities arising from the immediate relationship between masters and men, should greatly facilitate in the future the solution of social conflicts.

✽

### Zinc Corporation

A matter of importance in connection with the prospects of the Zinc Corporation is the decision of the directors to double gradually the capacity of the lead concentrator, at a maximum cost of £50,000, says the *Financial Times*, Feb. 10, 1914. It is understood that the mill extension is to be carried out in such a manner that it will be possible to change the mill from the treatment of lead ore to the treatment of zinc ore, or *vice versa*. Meanwhile, the Lyster process, or modification of the flotation process, is treating daily 100 tons of slime hitherto thrown away. The corporation is now securing nearly 90% of the original lead content of the heads in the form of a high-grade concentrate; about 7% of its recovery is obtained by the Lyster process, the cost of which is given at 4s. per ton of material treated.

The Horwood process is being applied to a certain by-product from the zinc concentrator, this byproduct being in effect a mixed zinc-lead concentrate. After a slight roast this material is amenable to flotation and yields on the one hand a fine zinc concentrate, and on the other, a good lead concentrate. The application of the Horwood process has increased decidedly the resources of the corporation.

When the tailings on hand at Broken Hill are exhausted (presumably in 1919) the Zinc Corporation expects to have a mine so developed and equipped as to be able to continue operations on the present scale. The mining property comprises two leases—No. 6, adjoining the area of the Broken Hill South Silver company, and No. 5, adjacent to No. 6. Most of the development work has been carried out in the South Blocks mine, and it is understood that about 300,000 tons are indicated by the present work, though not actually blocked out.

✽

### Progress in the Congo

According to the *Bulletin* of the Belgian Engineering Society, the monthly production from the Star of the Congo mine is now about 15,000 tons of ore, reduced by concentration to 8000 tons. The railway reached the Kambove mine in June of last year, but the section from Elizabethville to Kambove was only recently opened for traffic. The mine is producing now about 100 tons of ore per day, but in the coming year it is proposed to work opencast with steam shovels. At the Lushia mine, not far from Kambove, about 100 tons of ore are produced per day, which require briquetting. Various other mining centers are in the course of development, but labor is a difficulty.

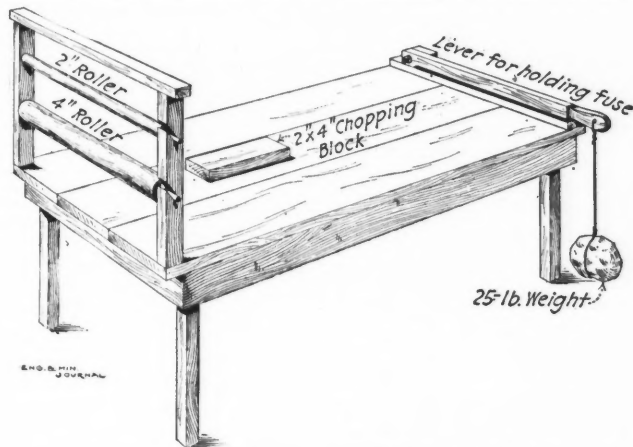


# Details of Practical Mining

## Another Fuse-Cutting Bench

By S. R. MOORE\*

The desirability of a fuse-cutting bench as a safety precaution and a time saver, is well recognized. A good bench used at the Success mine in Idaho is here shown. It is cheap and simple and has proved satisfactory. The bench is 3x9 ft. Two rollers, one 2 in. and one 4 in. in diameter, are mounted at one end to hold the fuse coil. One of the bearings for each roller pin is slotted, so that the rollers are easily removable. Across the opposite end of the bench is nailed a 1x2-in. slat, and on top of this is a lever made of 1½x2-in. material, slightly beveled on its lower edge, with a weight attached to its handle; the fulcrum end is raised just the thickness of a fuse, so that



ARRANGEMENT ON BENCH OF ROLLERS, CLAMP AND CHOPPING BLOCK

when the weight is applied, the lever bears equally upon all the fuses between it and the slot. A chopping block of 2x4-in. material is nailed at such a distance from the lever as to give the desired length of fuse, and in such a manner as to be easily replaced when worn out.

To use the bench, five large coils are placed on the larger roller, and five small coils on the smaller roller. It is found that by piling coils on top of one another, and pushing the roller through before removing the paper, no difficulty is experienced from the coils becoming entangled. The ends of 10 fuses are placed under the lever, and with one blow of a sharp ax on the chopping block, the fuses are easily cut to exactly the same length. The new, evenly cut ends are again placed under the lever before releasing the hold. The cut fuses are rolled in coils of ten each with the ends to be capped sticking out slightly. If a glancing blow be given on a good chopping block with a sharp ax, the end of the cut fuse will cap better than when cut with a knife and equally as well as when cut with a crimper. With a little practice, 500 fuses can be cut, coiled and counted in an hour, as compared with half a day when cut singly.

\*Superintendent of Success mine, Wallace, Idaho.

## Combining Core and Sludge Assays

By GEORGE S. ROLLIN\*

In the JOURNAL of May 6, 1911, W. S. Mead described the accepted methods of assaying the 5-ft. samples from diamond drilling and presented a handy device for deter-

TABLE OF PERCENTAGES OR MULTIPLIERS FOR DIAMOND-DRILL SAMPLES

No. of Core	E Extra Heavy Bit		E Medium Bit		E Standard Bit		E Mesaba Bit		A Bit		N Bit	
	Cuttings	Core	Cuttings	Core	Cuttings	Core	Cuttings	Core	Cuttings	Core	Cuttings	Core
1	99.6	0.4	99.5	0.5	99.4	0.6	99.4	0.6	99.4	0.6	99.2	0.8
2	99.2	0.8	99.0	1.0	98.9	1.1	98.9	1.1	98.8	1.2	98.3	1.7
3	98.8	1.2	98.5	1.5	98.3	1.7	98.3	1.7	98.2	1.8	97.5	2.5
4	98.3	1.7	98.1	1.9	97.8	2.2	97.7	2.3	97.6	2.4	96.6	3.4
5	97.9	2.1	97.6	2.4	97.2	2.8	97.2	2.8	97.0	3.0	95.8	4.2
6	97.5	2.5	97.1	2.9	96.6	3.4	96.6	3.4	96.4	3.6	94.9	5.1
7	97.1	2.9	96.6	3.4	96.1	3.9	96.0	4.0	95.8	4.2	94.1	5.9
8	96.6	3.4	96.1	3.9	95.5	4.5	95.5	4.5	95.2	4.8	93.2	6.8
9	96.2	3.8	95.6	4.4	95.0	5.0	94.9	5.1	94.6	5.4	92.4	7.6
10	95.8	4.2	95.1	4.9	94.4	5.6	94.3	5.7	93.9	6.1	91.6	8.4
11	95.4	4.6	94.7	5.3	93.8	6.2	93.8	6.2	93.3	6.7	90.7	9.3
12	94.9	5.1	94.2	5.8	93.3	6.7	93.2	6.8	92.7	7.3	89.9	10.1
13	94.5	5.5	93.7	6.3	92.7	7.3	92.6	7.4	92.1	7.9	89.1	10.9
14	94.1	5.9	93.2	6.8	92.2	7.8	92.1	7.9	91.5	8.5	88.2	11.8
15	93.7	6.3	92.7	7.3	91.6	8.4	91.5	8.5	90.9	9.1	87.3	12.7
16	93.3	6.7	92.2	7.8	91.0	9.0	90.9	9.1	90.3	9.7	86.5	13.5
17	92.9	7.1	91.7	8.3	90.5	9.5	90.4	9.6	89.7	10.3	85.1	14.3
18	92.5	7.5	91.3	8.7	89.9	10.1	89.8	10.2	89.1	10.9	84.8	15.2
19	92.1	7.9	90.8	9.2	89.4	10.6	89.2	10.8	88.5	11.5	84.0	16.0
20	91.7	8.3	90.3	9.7	88.8	11.2	88.7	11.3	87.8	12.2	83.1	16.9
21	91.3	8.7	89.8	10.2	88.2	11.8	88.1	11.9	87.2	12.8	82.2	17.8
22	90.8	9.2	89.3	10.7	87.7	12.3	87.5	12.5	86.6	13.4	81.4	18.6
23	90.4	9.6	88.8	11.2	87.1	12.9	87.0	13.0	86.0	14.0	80.5	19.5
24	90.0	10.0	88.3	11.7	86.6	13.4	86.4	13.6	85.4	14.6	79.7	20.3
25	89.6	10.4	87.9	12.1	86.0	14.0	85.8	14.2	84.8	15.2	78.9	21.1
26	89.1	10.9	87.4	12.6	85.4	14.6	85.3	14.7	84.2	15.8	78.1	21.9
27	88.7	11.3	86.9	13.1	84.9	15.1	84.7	15.3	83.6	16.4	77.3	22.7
28	88.3	11.7	86.4	13.6	84.3	15.7	84.1	15.9	83.0	17.0	76.4	23.6
29	87.9	12.1	85.9	14.1	83.8	16.2	83.6	16.4	82.4	17.6	75.6	24.4
30	87.5	12.5	85.4	14.6	83.2	16.8	83.0	17.0	81.8	18.2	74.7	25.3
31	87.1	12.9	84.9	15.1	82.6	17.4	82.4	17.6	81.2	18.8	73.9	26.1
32	86.7	13.3	84.4	15.6	82.1	17.9	81.9	18.1	80.6	19.4	73.0	27.0
33	86.3	13.7	83.9	16.1	81.5	18.5	81.3	18.7	80.0	20.0	72.2	27.8
34	85.8	14.2	83.5	16.5	81.0	19.0	80.7	19.3	79.4	20.6	71.3	28.7
35	85.4	14.6	83.0	17.0	80.4	19.6	80.2	19.8	78.8	21.2	70.5	29.5
36	85.0	15.0	82.5	17.5	79.8	20.2	79.6	20.4	78.2	21.8	69.6	30.4
37	84.6	15.4	82.0	18.0	79.3	20.7	79.0	21.0	77.6	22.4	68.8	31.2
38	84.1	15.9	81.5	18.5	78.7	21.3	78.5	21.5	77.0	23.0	67.9	32.1
39	83.7	16.3	81.0	19.0	78.2	21.8	77.9	22.1	76.4	23.6	67.1	32.9
40	83.3	16.7	80.5	19.5	77.6	22.4	77.3	22.7	75.7	24.3	66.3	33.7
41	82.9	17.1	80.1	19.9	77.0	23.0	76.8	23.2	75.1	24.9	65.4	34.6
42	82.4	17.6	79.6	20.4	76.5	23.5	76.2	23.8	74.5	25.5	64.6	35.4
43	82.0	18.0	79.1	20.9	75.9	24.1	75.6	24.4	73.9	26.1	63.8	36.2
44	81.6	18.4	78.6	21.4	75.4	24.6	75.1	24.9	73.3	26.7	62.9	37.1
45	81.2	18.8	78.1	21.9	74.8	25.2	74.5	25.5	72.7	27.3	62.0	38.0
46	80.8	19.2	77.6	22.4	74.2	25.8	73.9	26.1	72.1	27.9	61.2	38.8
47	80.4	19.6	77.1	22.9	73.7	26.3	73.4	26.6	71.5	28.5	60.4	39.6
48	80.0	20.0	76.7	23.3	73.1	26.9	72.8	27.2	70.9	29.1	59.5	40.5
49	79.6	20.4	76.2	23.8	72.6	27.4	72.2	27.8	70.3	29.7	58.7	41.3
50	79.2	20.8	75.7	24.3	72.0	28.0	71.7	28.3	69.6	30.4	57.8	42.2
51	78.8	21.2	75.2	24.8	71.4	28.6	71.1	28.9	69.0	31.0	56.9	43.1
52	78.3	21.7	74.7	25.3	70.9	29.1	70.5	29.5	68.4	31.6	56.1	43.9
53	77.9	22.1	74.2	25.8	70.3	29.7	70.0	30.0	67.8	32.2	55.2	44.8
54	77.5	22.5	73.7	26.3	69.8	30.2	69.4	30.6	67.2	32.8	54.4	45.6
55	77.1	22.9	73.3	26.7	69.2	30.8	68.8	31.2	66.6	33.4	53.6	46.4
56	76.6	23.4	72.8	27.2	68.6	31.4	68.3	31.7	66.0	34.0	52.8	47.2
57	76.2	23.8	72.3	27.7	68.1	31.9	67.7	32.3	65.4	34.6	52.0	48.0
58	75.8	24.2	71.8	28.2	67.5	32.5	67.1	32.9	64.8	35.2	51.1	48.9
59	75.4	24.6	71.3	28.7	67.0	33.0	66.6	33.4	64.2	35.8	50.2	49.8
60	75.0	25.0	70.8	29.2	66.4	33.6	66.0	34.0	63.6	36.4	49.3	50.7

Note—The values of the separate assays made for cuttings and core in a 5-ft. run should be multiplied by the respective percentages found in the column headed by the size of the bit used, opposite the number of inches of core recovered. The results are to be added and divided by 100 for the average assay for the sample.

mining the relative importance of the core portion and the cuttings portion of each sample and of combining them to give a correct result. The table given herewith is designed to take the place of the device mentioned and yields results somewhat more rapidly and easily. The

\*Formerly district superintendent, E. J. Longyear Co., Crystal Falls, Mich.

ratio of core to cuttings will vary, of course, with the type of bit used. The six types for which figures are given here are standard Longyear bits. The method of use will be evident from the footnote, but an example may be given. Suppose 20 in. of core to have been got, using an *E* extra-heavy bit. The core assayed 51 % iron; the cuttings assayed 58%. The 51% assay is multiplied by 8.3, got from the table, and the 58% by 91.7. The results, 453 and 5309 are added and divided by 100, giving 57.62%, the true assay value of the sample. When the core recovered is less than 8 or 10 in., its assay can be neglected, as when properly weighted according to the table its influence on the result is exceedingly slight.

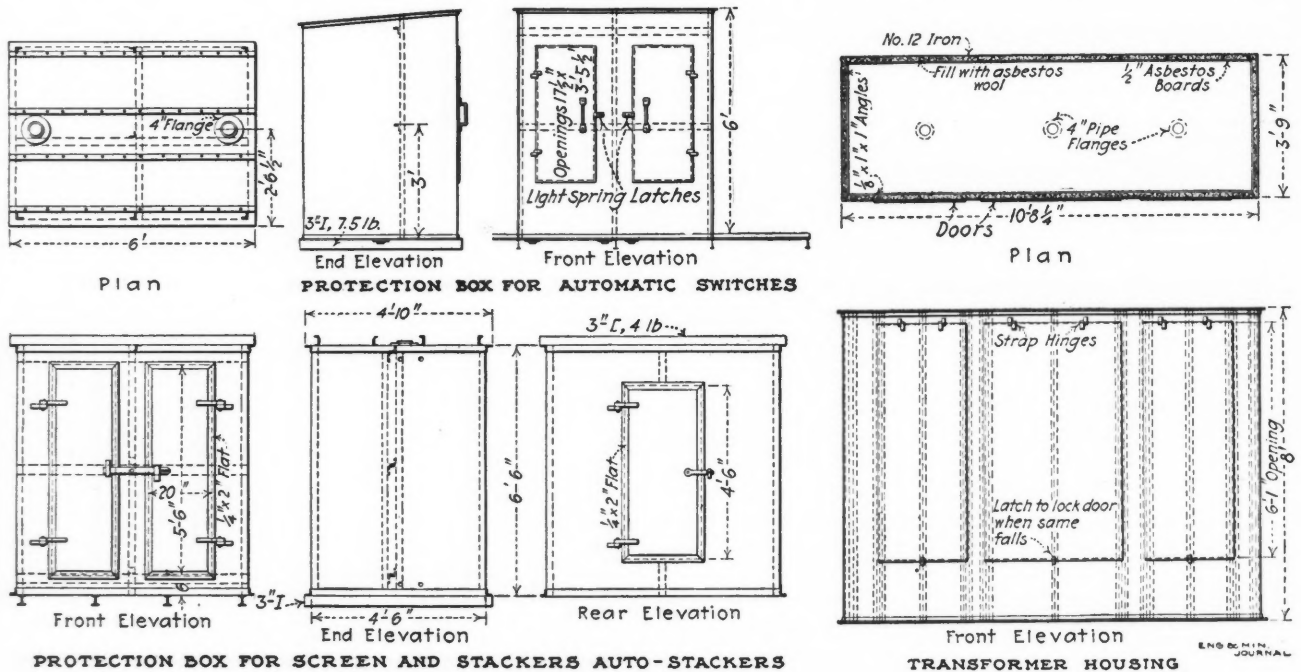
### Fire Protection for Electrical Equipment

BY LEWIS H. EDDY\*

Devices for protection against fire originating in electrical apparatus, have been installed on its wooden-hull

is automatically closed. In the roof of the box above each transformer there is an eye-bolt, and from each of these eye-bolts a fusible link carries a rope that holds the door open. In case of fire this fusible link melts and the doors drop down. The length or height of the doors is 6 ft., leaving an 18-in. baseboard or frame across the front at the bottom of the box, which prevents the oil from running out. The center door is 3½ ft. wide. The two other doors are each 2½ ft. wide. This difference in width is due to the difference in the size of the tanks. One 4-in. drain pipe is placed inside the housing underneath each transformer. A 3-in. drain pipe is placed around the small tank inside the housing, and this 3-in. pipe telescopes into the 4-in. pipe. The inclosure, or housing rests on 3-in. I-beams. There is a hole through the top of the housing over each transformer, through which a chain can be run for lifting the transformer.

The box for automatic switches is also made of No. 12 iron. This inclosure is not lined with asbestos lumber, as it stands entirely away from any part of the housing



DETAILS OF FIRE PROTECTION BOXES FOR ELECTRICAL APPARATUS

gold dredges by the Natomas Consolidated, of California, in the American River district, consisting of boxes on the main transformers, automatic switches and screen and stacker auto-starters.

The main transformer box inclosing three transformers on No. 6 dredge, is 10 ft. 8¼ in. long, 45 in. wide and 8 ft. high. The dimensions vary on the several boats according to requirements. The box is made of No. 12 iron; the floor is of ¼-in. iron and the floor and housing are both lined with ½-in. asbestos lumber. The 1-in. space between the iron and the asbestos is filled with asbestos wool. The iron and the asbestos lumber are spaced and held together by Z-bars, made by riveting together two 1/8x1-in. angle irons.

There is a door opening to each transformer, hinged at the top and kept open except in case of fire, when it

of the dredge. The cable is run to this point before it enters the boat and is protected by an automatic time-limit relay switch. The line-transformer lead and the leads for the fire-pump transformers are tapped into this switch and from this switch inclosure the distribution is made over the boat. The conduit pipes are carried through the bottom of this box and into and through the boat. After the conduits are all installed, the bottom of the inclosure is grouted about 2 in. There is a drain pipe in the bottom leading to the pond and extending about 2 ft. into the water.

The auto-starter box, installed on No. 9 dredge, is 6 ft. high, 5 ft. long and 4 ft. wide. The walls are made of No. 12 iron. The bottoms are grouted about 2 in. deep. Where there are two controllers for the screen and stacker, channel iron is used in the roof of the inclosure.

These devices were all designed and installed by the electrical department of the Natomas Consolidated, in

\*Associate editor, "Engineering and Mining Journal," San Francisco, Calif.



charge of L. J. Matteson, chief electrical engineer. The work was done in the company shops at Natomas, under the supervision of L. D. Hopfield, superintendent.

### Small Timber Framing Plant

BY FRANK M. LELAND\*

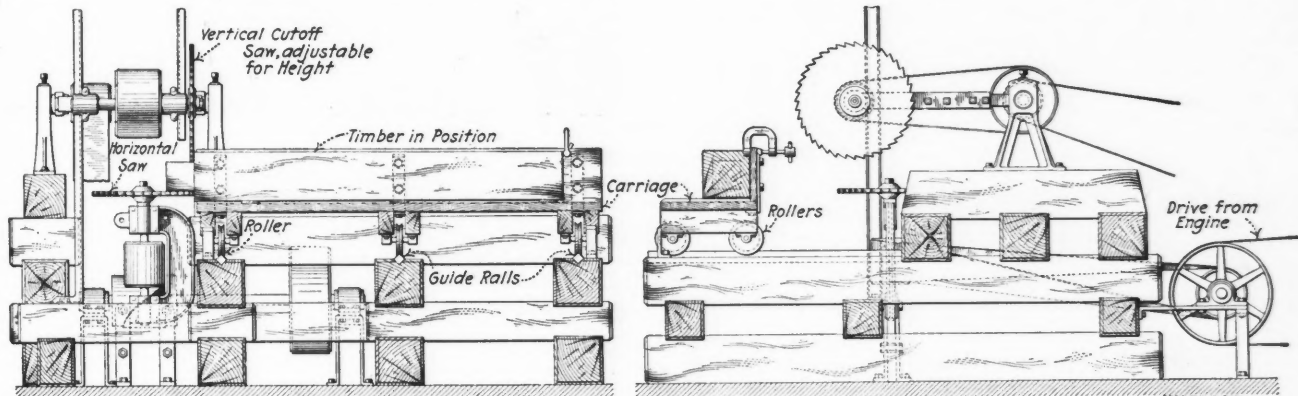
About two years ago, we found ourselves in the position of a great many medium-sized mines. We needed a large quantity of square sets and had been doing the same as most mines of this size, viz., cutting trees, hauling them in full length and dumping them in our timber yard, paying for them by the linear foot. We kept five or six timber framers working under a shed and they would go out and select timbers to suit, saw them off with a two-man crosscut saw, roll them under the shed, hew one side flat with a broadax and then get out a little gage, mark off the ends and proceed in the usual manner to saw them part way in and frame the ends as required. By the time they had ground up their tools and filed their saws, filled their pipes and lighted them, gone into the boiler room in winter to warm their fingers and per-

the usual well known manner, they made the finished timbers cost about as much as before.

I then began to figure how I could take the machinery and frame the timbers; the drawing illustrates how we did it. I built a frame of 8x8-in. timbers and laid the cut-off saw frame horizontal instead of vertical. I rustled up an old vertical 7x10-in. engine and connected it as shown, using channel irons with slotted holes so that the saw frame would move up and down, cutting any depth desired, or could be lowered clear down and used to square the timbers.

I then rigged up another saw running horizontally. This does not cut at the same time as the vertical saw, hence only power enough is required to drive one saw at a time. The design is not beautiful, it was made without drawings, and figured out as we went along. The guide rails under the table are made from 1½-in. square iron set edgeways; the rollers we turned out of some old matte pans; the pulleys and shafting, we picked up around the place. The machine is strictly homemade, but it is good and strong and it runs perfectly.

The posts are first sawed on the slabber, they are next



THE HOME-MADE FRAMER, SHOWING BED, CARRIAGE AND JAWS

formed a few other functions that every mine manager is familiar with, these hand-framed timbers had cost us a great deal of money. Up to two years ago, we had not required so many and we did not notice the expense so much, but when I found that we required a great many timbers, I began looking around for machinery.

The first thing we considered was a regular timber framing machine, but found on getting prices that one would cost from \$2500 to \$3000, weigh about 9000 lb., and require a 50-hp. engine and boiler to drive it and then it would only cut the tenons on the ends.

I figured the cost of a building and all the machinery erected, and found it would approximate about \$7000, which, for the work we had to do, was too large an investment. So I thought I would buy a slabber and a swinging cut-off saw and rolling the timbers to the cut-off saw, cut them in lengths to suit, and slab them on one side in order to get a starter for hand work. I purchased the slabber, complete with saw and the swinging cut-off saw for \$420. We erected it at the smelting plant and cut off and slabbled a lot of timbers, but it proved a disappointment; the timber framers rather resented our taking their work away from them and in

squared on the ends by running through the machine, say one hundred of them, the saw is then raised up so as to cut just 2 in. deep. The horizontal saw remains stationary, the stick is shoved through and the cut made on top, the carriage is then shoved on the horizontal saw and a slice taken out of the bottom; it is then pulled back and rolled over one quarter and the operation repeated; it requires four cuts to finish the end.

I have repeatedly timed it and find that it averages 3½ min. to frame both ends of an 8x8-in. post. We use the same style of timbering as illustrated in Fig. 1, p. 879 of the JOURNAL, Nov. 8, 1913, with the exception that we use 8x8-in. instead of 10x10-in. material. We also frame the cap, called the girt in the figure mentioned; the piece which we call the girt is simply an 8x8-in. piece squared on both ends.

The slabbing saw takes logs up to 8 ft. in length and when we received it, we made a set of dogs and some perforated plates to hold pins, and bought an inserted tooth saw to replace the thin saw which came with it; it is surprising how fast we can rattle out the timbers. When we started, all we hoped to make was square-set timbers, but we found that by getting logs 8 ft. long, we could make our lumber for just about one-half its cost when purchased from the saw mills. We found also

\*Mr. Leland wrote this article when president of the Empire Copper Co., Mackay, Idaho. He is now general manager of the Balaklala Copper Co., Coram, Calif.

that we could saw 2x4-in. stuff for ladders, 4x6-in. for flooring for the square sets, in fact, almost anything up to 8 ft. long, and we find that 2x12-in. by 8-ft. lumber is just as good for chutes, etc., as is 16-ft. We always square the ends before sending to the mine, making the planks exactly 8 ft. long and by putting the sets in the chutes on 4-ft. centers, there is no sawing to be done in the mine by candle light with a dull saw; this saves money.

We rigged a little wedge saw to use up the scraps and find that our wedges cost us  $\frac{3}{8}c.$ , whereas, made by hand, they cost us 6c. We also make ladder rounds  $2\frac{1}{2}$  in. square by 16 in. long, ripping them on the small mill. We find many advantages which we did not think of at the start. The principal one is the fact that from every timber we get four slabs, two of which are generally good for lagging and in almost every case we get enough lagging from the timber to pay for the timber itself, since we would have to use 2-in. plank, if we did not have this lagging. Furthermore, the boiler being purposely left naked, warms up one end of the shop and for the other we use live steam in coils of pipe; the fuel costs nothing, since we burn the saw dust. This is quite an item, as it ordinarily takes from 300 to 400 lb. of coal daily to keep the shop warm.

Finally, these machine-framed timbers can be erected in the mine at a lower cost for labor than the hand-framed, since they are all true and fit exactly.

supported on angles along one side, serves as a walk when it is necessary to inspect the pipe or pack the slip joints. The cross-braces are spaced  $3\frac{1}{2}$  ft. center to center and as many are used as the height of the bent requires.

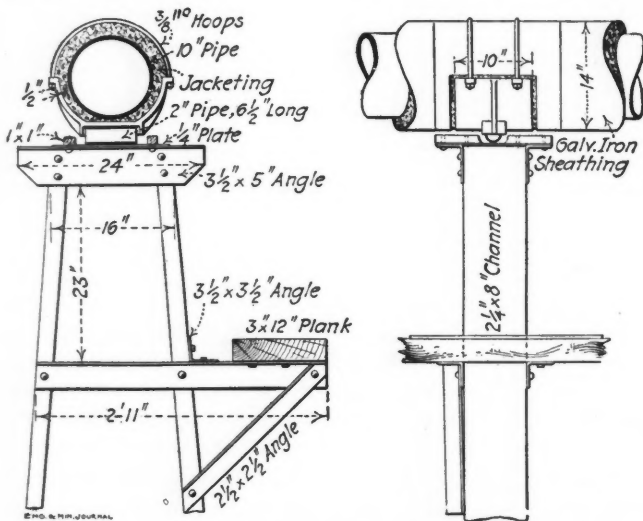
The manner of holding the pipe on the top of the bent so as to permit longitudinal motion, is of interest. The pipe is jacketed with insulating material and sheathed in galvanized iron wired on. A cast saddle at each bent is bolted to the bottom of the pipe with two  $\frac{3}{8}$ -in. bolts, over the top. The bottom of this casting is a socket which fits



PIPE LINE FROM THE BOILER HOUSE

### Surface Steam-Line Supports

The accompanying illustrations show the method adopted in the Norrie group of mines at Ironwood for supporting an outdoor steam pipe. The steam is con-



TOP OF A BENT SHOWING SADDLE AND ROLLER

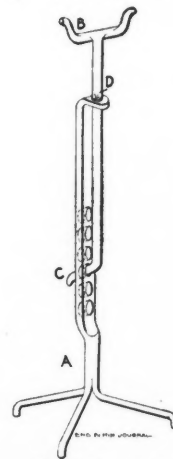
veyed some distance from the boiler house to the hoist at one of the shafts. The pipe is carried on the structural-steel bents shown in order to maintain the desired grade over the variable ground.

The bents are spaced about 15 ft.; every 200 ft. approximately a slip joint is inserted to take care of expansion. This is carried on the structure shown near the center of the photograph. The bents are set on concrete foundations to which they are held by plates bent at an angle, riveted to the legs and bolted to the concrete. The 3x12-in. plank

over a short section of 2-in. pipe. This pipe acts as a roller; it is free to roll longitudinally on a plate which forms the top of the bent, but is held against lateral motion by 1x1-in. pieces riveted to the plate. The details of construction of the top of the bent are evident from the drawing.

### Blacksmith Stand

The rest illustrated is of simple design and inexpensive to make; it will be found useful for holding up light work in the machine shop or smithy (*American Machinist*, Jan. 29, 1914). It consists



STAND FOR SUPPORTING BARS

of a standard A, which has three feet, and of a rest B. The rest is adjusted to the desired height by putting its lower end C through one of the holes in A. These holes are bored or punched about  $1\frac{1}{2}$  in. apart, and should be made at an angle, as shown by the dotted lines, so as to insure a safe hold of the shank when weight is placed upon the rest B. The hole in the head of the standard marked D through which the shank of the rest slides up and down, must be made large enough to allow for the movement of the shank when the point C is being taken out, or being put through any of the holes in the standard A.

The Use of Nichrome Heating Elements in Roasting Furnaces is patented by Utley Wedge (U. S. pat. 1,088,496). The nichrome wire is placed upon the roofs or arches to be heated, and worked by radiation downward.



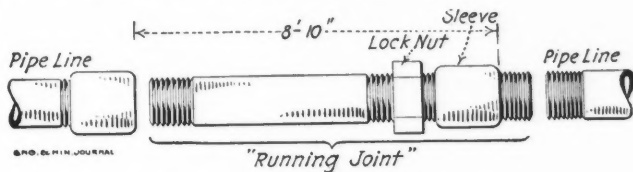
# Details of Metallurgical Practice

## Running Joint, to Replace Unions

BY A. M. MERTON\*

Of all pipe fittings the ordinary union is the least satisfactory. Yet, around a mill or in the mine, no one would think of running a long line of pipe without putting in a union or two. Otherwise when the line has to be broken for the purpose of making a new branch line, or for a score of other reasons, a great length has to be taken apart in order to insert the tee or a new valve or what not. The union, after having been unscrewed several times, almost invariably leaks, especially if under considerable pressure. Moreover a pipe line is always weak at a union, and if the line is carried on trestles or along a wall it has to be supported at or very close to the union.

A device that overcomes most of the troubles of the union is what the mechanic who showed it to me calls a running joint. I have used it ever since and have found it thoroughly good. It does away with leaks and the pipe line is as strong at the joint as in any other part. Moreover in breaking the joint the pipe does not require being sprung apart as far as when a union is used thus avoiding strains in the other couplings.



A CONVENIENT PIPE FITTING

The running joint is merely a short piece of pipe, say 8 inches long for a 1½-in. pipe, with a thread cut at each end. At one end is an ordinary coupling. At the other end the pipe thread is cut about 1½ times the length of the coupling—long enough to leave the end of the pipe exposed, when first a locknut and then the coupling is screwed back on the pipe.

In putting in a pipe line, one or more of these running joints should be inserted at some convenient point, chosen for accessibility. In erecting, the threads should be given a light coat of thin red and white lead mixed in oil. Such a mixture does not harden as much as red or white lead alone. The object of this coating is not merely to keep the joint tight but also to prevent rusting of the threads and making it difficult to break the joint. After the coupling on the long thread has been run forward on to the end of the long pipe, the locknut is run forward to jam against the end of the coupling. Before making tight, however, a few threads of oakum dipped in the oil and lead are wrapped around the pipe as close to the coupling as possible. This absolutely prevents any steam or air leak and is an effective gasket.

\*Colorado City, Colo.

But too much oakum should not be used, only three or four threads.

In a large heavy pipe the running joint can be made double, that is, a long thread and a lock nut at each end. Thus the whole section of pipe can be removed if desired. Up to 2½-in. pipe the single joint is usually sufficient.

## Electrical Power at Nipissing

The Nipissing low-grade mill, at Cobalt, Ontario, as described by James Johnston, in *Bull. A. I. M. E.*, January, 1914, uses electrical power for operation, and the plan has been to adjust each motor as exactly as possible to the work it has to do, obtaining the highest efficiency and power factor. The motors are all three-phase, 60-cycle, 550-volt, Canadian Westinghouse type G. M. machines. The squirrel-cage rotor was selected on account of its strength and simplicity. The average full-load efficiency and power factor of these machines is:

	Efficiency %	Power Factor %
125 hp. class	91	89.6
80 hp. class	89	88
40 hp. class	88.3	86.9
35 hp. class	87.5	83.6
15 hp. class	85.8	85.5

Each motor is provided with a control panel upon which are mounted a three-pole automatic oil circuit-breaker, an auto-starter, fitted with no-voltage release, an ammeter, and a serviceable inverse time-limit relay in the form of fuses, and a double-pole spring tumbler switch, inserted across the circuit-breaker tripping-coil terminals.

### ORIGINAL MOTOR-POWER DISTRIBUTION

Washing Plant: operates 6 days of 9 hr. each, per week:	Motors	Horsepower	Rev. per Minute	Total Horsepower
Main drive	1	40	850	
Aerial tram line	1	15	565	
Surface hoist	1	30	720	
Elevator hoist	1	10	900	95
<b>Battery:</b>				
Battery drive	4	40	575	
Return solution pump	1	40	575	
Elevator ore bin	1	10	1120	
Conveyor belt	1	5	1800	215
<b>Tube Mills:</b>				
Mill drive	4	125	580	
Lower classifiers	1	5	1120	505
<b>Treatment:</b>				
Agitating tanks	1	125	485	
Circulating slime	1	35	835	
Circulating desulphurizing	1	20	690	
Alkalai pump to cyanide tanks	1	20	690	
Experimental plant	1	2	1800	202
<b>Two Filters:</b>				
Filter box—cyanide	1	80	870	
Filter box—alkali	1	35	855	
Vacuum pump—cyanide	1	10	570	
Hydraulic valves	1	1	1200	126
Precipitation	1	10	570	10
<b>Water Service:</b>				
Centrifugal pump	1	25	1800	25
	27			1178

Cost of installation, \$24.15 per horsepower of motors.

This relay is used for starting duty only, and in conjunction with the no-voltage release on the auto-starter, renders the gear practically foolproof. The motor-control panels, 1 ft. 6 in. wide by 6 ft. high, are grouped to make switchboards of convenient size, and are so placed that the machines they control may be easily seen from them.

The main switchboard is equipped with an automatic three-pole oil circuit-breaker, controlling the entire mill supply, a voltmeter, an ammeter, an integrating watt-

meter and a graphic recording wattmeter. The wiring of the graphic wattmeter is so arranged that a record of either the total mill load or the load of any individual motor may be obtained.

All wiring within the mill is carried in steel conduits. The average total load on the mill amounts to 690 kw. The recording wattmeter registers a variation of less than 5% from this figure from day to day, on the day load.

✽

### Cost of Power-Plant Apparatus

W. J. Downing, in *Power*, gives the following figures:

**Boilers**—Horizontal fire-tube boilers set in place complete with trimmings ready for steam and water connections cost \$12 per horsepower.

The Manning type of vertical boiler for power-plant work will cost \$10 per horsepower erected.

Water-tube boilers set in place with trimmings cost \$14 to \$16 per horsepower.

Internally fired boilers of the Morrison type cost \$16 to \$18 per horsepower, including trimmings.

Dutch or extended ovens are often used in power plants for burning a low grade of fuel, or utilizing the waste material from manufactured products. These ovens will cost \$250 for a 300-hp. unit.

Superheaters cost \$2.25 to \$3 per horsepower, depending on the size and type.

Special boiler settings designed to economize heat, similar to the Smith setting, cost about \$150 per boiler.

All of the above prices are based on boilers with plain grates. Shaking grates should be figured at from \$5 to \$6 per square foot of surface.

Feed-water heaters of the closed type cost from 75c. to \$1 per horsepower, depending on the size of the unit. Feed-water heaters and purifiers of the open type cost \$2.20 per horsepower for a 100-hp. unit and \$1 per horsepower for a 1000-hp. unit. Intermediate sizes cost a proportional amount.

A good damper regulator for controlling the draft in boilers can be obtained for \$50.

Boiler-feed pumps cost 50c. per horsepower capacity of units of 150 to 200 hp. Blowoff and return tanks suitable for 100 lb. pressure cost about 8c. per pound in weight.

**Pipe Fittings and Valves**—While there are several large manufacturers of these products it is usually safe to figure the following discounts: Steam pipe, 75%; valves, 50 to 60%; cast-iron fittings, 70%; spiral-ripped pipe, 70%.

An accurate list should be made of the actual material required for any particular installation, as there are too many variables to use a unit price per horsepower capacity of the plant. The labor cost will average \$1.50 per horsepower for connecting the boilers and installing the basement mains in plants of 200 to 400 hp.

**Covering**—An asbestos covering 4 in. thick for boilers and heaters will cost in place 50 to 60c. per sq.ft. of surface. Air-cell covering 1 in. thick will cost 22c. per sq.ft. Eighty-five per cent. magnesia 1 in. thick will cost 30c. per sq.ft. These prices include the labor required to apply and are useful in calculating the cost of covering heating ducts and smoke flues.

Steam-pipe covering made of 85% magnesia will cost one-half of the list price, including the labor of applying. If desired the discounts applying to the various

types of covering can be obtained and the labor cost based on the fact that one man will cover 100 ft. of straight pipe per day up to 4-in. diameter or will cover 40 fittings per day up to 4-in. size. The above amounts will be more for larger sizes due to the increased labor of handling.

**Ventilating Apparatus**—Centrifugal steel-plate fans for ordinary systems in which the total pressure does not exceed  $\frac{3}{4}$  oz. will cost \$8 to \$12 per 1000 cu.ft. of air per min. capacity, depending on the size.

Direct-current motors for driving fans will cost \$18 to \$25 per horsepower. Regulating rheostats cost 60% of the list prices.

High-pressure engines for fan driving cost \$10 to \$16 per horsepower. Low-pressure engines for fan driving cost \$18 to \$22 per horsepower. Erection of fans and motors will cost about 1c. per pound in weight.

**Galvanized-Iron and Steel-Plate Work**—Piping arrangements employing galvanized-iron distributing ducts cost about 15c. per lb. in place. Steel-plate work for smoke flues costs from 6 to 8c. per pound.

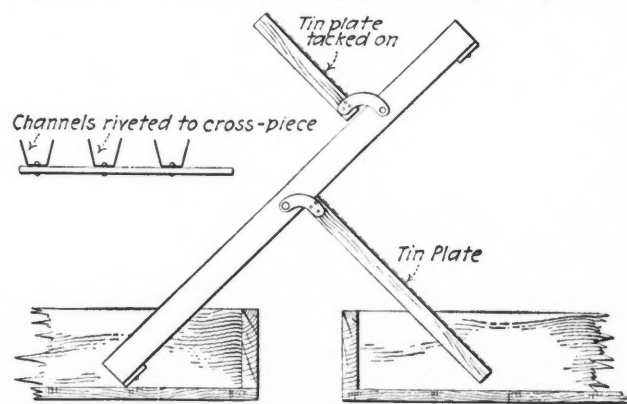
**Foundations**—Allow 75c. per cu.yd. for excavation in ordinary soil and \$4 per cu.yd. for rock. Brick foundation walls cost 40 to 50c. per cu.ft. in place. Concrete foundations cost \$6 to \$7 per cu.yd. for the concrete and 15c. per sq.ft. of surface for the forms. Waterproofing will cost 40c. per sq.ft.

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### A Riffle for Reducing Samples

BY A. LIVINGSTONE OKE\*

In the diagram is shown a simple form of riffle for use in reducing the size of samples to suitable proportions for fine grinding. It consists of the ordinary set of riffles to which have been riveted loosely two hinged flaps, which



PORTABLE SAMPLING RIFFLE

fold down when the apparatus is not in use. The channels may be made from stout tin plate, such as that in oil cans, and they are riveted firmly at both ends to cross-pieces of flat iron. The flaps are hinged at the sides of the outer channels, by strips bent as shown, to permit folding down flat for storing, while at the same time affording a firm seating when extended for use. These flaps should preferably be made of wood, covered with thin sheet metal, to facilitate cleaning. This form of riffle will be found to be convenient for an engineer who requires to carry a light apparatus with him on inspections, to avoid the usual laborious coning and quartering of samples at the place where they are taken.

\*Penzance, Cornwall, England.

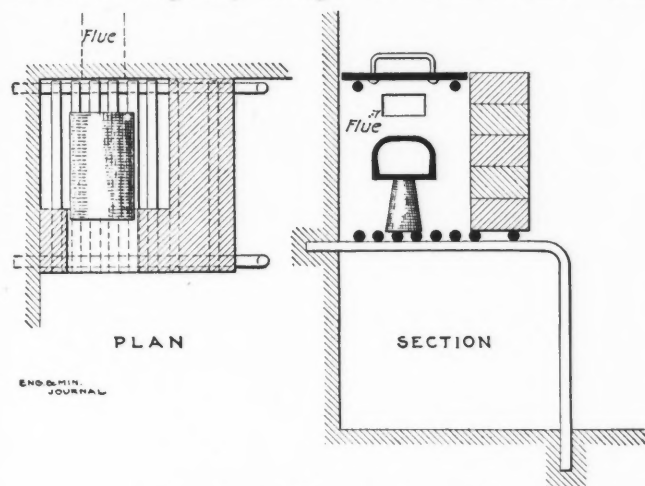


# The Assayer and Chemist

## A Simple Muffle Furnace

By A. LIVINGSTON OKE\*

Some years ago, when I was in charge of a mine in a remote part of the Andes, it became necessary to build a muffle furnace in a hurry, the only material available being a few adobe bricks, some 1-in. round iron and a muffle. The accompanying diagram illustrates, approximately to scale, the furnace that was built and which worked so well that it is probably still in operation. It was placed in the corner of the assay office, bricks being used for two sides only, and was not strapped or secured in any way to the walls, apart from an occasional luting with clay. It was low, due to the necessity of using a flue which originally belonged to a wind furnace. The

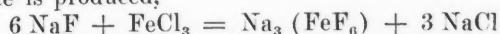


AN ADOBE MUFFLE FURNACE

fuel used was charcoal; the round-iron fire-bars are easily renewed when burnt out. The bricks were laid in clay and the whole arrangement was up and running in a few hours, the only difficulty being the somewhat awkward position.

## Volumetric Determination of Fluorine

A. Greef's volumetric method for fluorine (*Ber.*, 1913, p. 2511; abstr. *Journ. Soc. Chem. Ind.*, Oct. 31, 1913) depends on the fact that when a neutral aqueous solution of ferric chloride is added to a solution of alkali fluoride, a white precipitate of a composition analogous to that of cryolite is produced,



0.5 gram of the material to be tested is dissolved in 25 c.c. of hot water, the cooled solution (which must be neutral to phenolphthalein) is treated with 20 grams of sodium chloride and 5 c.c. of potassium thiocyanate solution (100 grams dissolved in 500 c.c. of water) and titrated with a standardized solution of ferric chloride (100 c.c. = about 1 gram NaF) till a yellow color is

\*Penzance, Cornwall, Eng.

produced. 10 c.c. of alcohol and 10 c.c. of ether are now added, the whole shaken vigorously, and the titration continued until the ether layer is permanently colored red. In the case of commercial sodium fluoride, which usually contains some acid fluoride and silico-fluoride, these are converted into fluoride by titration with alkali in presence of phenolphthalein, and then the total fluoride is determined as described above. The acid fluoride is determined alone by titrating with alkali a portion of the sample in aqueous alcoholic solution, in presence of potassium chloride, which converts the silico-fluoride into insoluble potassium silico-fluoride.

## Effect of Temperature on Conductivity Bridge Readings

By R. F. WOOD\*

As electrical conductivity is one of the simplest and most universal tests for copper, any factor affecting the results of this test will be of some general interest.

The variation in conductivity readings taken on the same wire at different temperatures is often noticeable, especially if the sample has a conductivity different from that of the wire which is used for the standard conductor in the bridge. A sample of say 85% conductivity, tested against a standard of 100% may show variations as great as 1% if tested when the room is cold and again when it is hot. While it seldom happens that even such differences in low-conductivity copper become commercially important, and while it is also true that these differences in case of high-conductivity copper, though appreciable, will usually fall within the combined error of sampling and testing, it still is gratifying to those who are using conductivity bridges to be able to correct for these differences not only by their own experimental determinations and by the information heretofore available, but also by the more accurate and consistent calculations made possible by the work recently carried on by the Government in its investigations of the resistivity and the temperature coefficient of resistance of copper.

In Circular No. 31, of the Bureau of Standards, attention is called (p. 11) to the desirability of using the 20° C. value of resistivity when computing the per cent. conductivity. The example there cited is a copper wire of 0.1597 ohm (meter, gram) resistivity at 20° C. Dividing the value for the "annealed copper standard" (0.15328 at 20° C.) by this gives the conductivity of 96.0%. But at 0° C., the resistivity of the standard has become 0.15328 - 20 × 0.000597 or 0.1413, and of the sample 0.1597 - 20 × 0.000597 or 0.1478. The latter figures give a result of 95.6 per cent.

By making this calculation for various degrees of temperature and for various conductivities, a table may be deduced which will show for any sample the expected difference between the reading at a given temperature and the reading which would have been obtained on the same

\*Quincy Smelting Works, Hancock, Mich.

sample if tested at 20° C. The table herewith given is abbreviated from one in use at the Quincy Smelting Works, Hancock, Mich., for reducing the readings of a Hoopes bridge, and may be used wherever, as here, the standard wire of the bridge has a conductivity of approximately 100 per cent.

TABLE FOR CONDUCTIVITY = TEMPERATURE CORRECTIONS

Per Cent.	10° C	15° C	20° C	25° C	30° C
102	+0.09	+0.04	0	-0.04	-0.08
100	0	0	0	0	0
98	-0.08	-0.04	0	+0.04	+0.07
96	-0.16	-0.08	0	+0.07	+0.14
94	-0.23	-0.11	0	+0.11	+0.21
92	-0.30	-0.15	0	+0.14	+0.28
90	-0.36	-0.18	0	+0.17	+0.34
85	-0.51 (0.48)	-0.25	0	+0.24	+0.48
80	-0.64 (0.62)	-0.31	0	+0.31	+0.60 (0.62)
75	-0.75 (0.73)	-0.36	0	+0.36	+0.71 (0.73)
70	-0.84 (0.83)	-0.41	0	+0.40	+0.80 (0.81)

Referring to the above table, it will be seen that, for example, a wire which at 20° C. (68° F.) has a conductivity of 75.00% should at 30° C. (86° F.) yield a reading of 75.71%. If on the other hand, it is desired to find the 20° C. value for a wire which at 30° reads 75.00%, the sign in the table must be reversed, and the figure in parenthesis used, giving in this case 75.00 — 0.73 or 74.27%. The distinction made by the figures in parenthesis is so small as not to be of practical moment, and is here given only for completeness, and is noted only where the total correction is 0.50% or over. In accepting the values of the table, thermal expansion of the wires and of the fixtures of the bridge is taken as compensating between the standard and the sample.

COMPUTED AND EXPERIMENTAL TEMPERATURE CORRECTIONS

15° C			20° C			25° C			30° C		
Reading	Found	Difference Computed	Conductivity	Reading	Found	Difference Computed	Conductivity	Reading	Found	Difference Computed	
100.30	0.00	0.00	100.30	100.25*	-0.05	0.00	100.25**	100.25**	-0.05	0.00	
94.90	-0.20	-0.10	95.10	95.15	+0.05	+0.10	95.20	95.20	+0.10	+0.20	
89.60	-0.20	-0.20	89.80	89.95	+0.15	+0.15	90.10	90.10	+0.30	+0.35	
84.55	-0.25	-0.25	84.80	85.05	+0.25	+0.25	85.30	85.30	+0.50	+0.50	
79.60	-0.45	-0.30	80.05	80.25	+0.20	+0.30	80.65	80.65	+0.60	+0.60	
74.65	-0.50	-0.35	75.15	75.40	+0.25	+0.35	75.85	75.85	+0.70	+0.70	
69.90	-0.40	-0.40	70.30	70.65	+0.35	+0.40	71.10	71.10	+0.80	+0.80	

\* At 22°

\*\* At 28°

For practical use, the table may be calculated for every other per cent. and every other degree, and the values rounded off to the nearest 0.05%. Actual tests of several wires, using a Hoopes bridge, gave the above results, in general conformity with the calculated values of the table.

Instead of computing the values in the manner shown in the third paragraph, they may be found from the following formula:

$$N = \frac{N_t}{1 + 0.0039(n - N_t)(t - 20)}$$

where  $N$  = the per cent. conductivity of the sample, at 20° C., and expressed decimally;  $N_t$  = the reading of the bridge, at  $t$ ° C., and expressed decimally (e.g., for a reading of 90.35%,  $N_t = 0.9035$ );  $t$  = the temperature of observation in degrees C.;  $n$  = the per cent. conductivity of the standard conductor in the bridge (20° C. value), expressed decimally.

The constant 0.000597 ohm (meter, gram) change of resistivity per degree, on which this formula is based, was determined by the bureau for conductivities of over 94%; that it may be applied without great error to copper of lower conductivities is indicated by the Reichsanstalt results cited on p. 99, of Vol. 7, No. 1, of the Bulletin of the Bureau of Standards; also by the conformity of results noted in this paper.

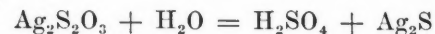
## Gravimetric Determination of Calcium as Oxalate

Calcium is usually estimated by precipitating as oxalate, which is then weighed as CaO or CaCO<sub>3</sub>. Goy, according to the *Chemical Trade Journal*, describes attempts made to obtain satisfactory results by weighing as oxalate, the following details giving complete success. The calcium is precipitated by ammonium oxalate in boiling solution, which is kept hot on the water-bath during the settlement of the precipitate. The precipitate is collected in a gooch carefully and closely packed with asbestos, washed three or four times with small quantities of hot water, and dried at 100° to 105° C. for about four hours. It then consists exactly of CaC<sub>2</sub>O<sub>4</sub>, H<sub>2</sub>O, but, though it may be dried at 100° C. for many hours further without change of weight, at 130° it slowly loses water.

✂

## Volumetric Determination of Thiosulphates in Presence of Sulphites

The addition of silver nitrate to a solution containing thiosulphate causes the following reaction to take place in the cold:



any sulphite present giving silver sulphite only decom-

posed on boiling (*Zeit. anal. Chem.*). The solution to be examined is added to an excess of 2% silver-nitrate solution diluted with 60 to 70 c.c. of water in a 100-c.c. flask, and well agitated until the liquid is perfectly clear. The volume is then made up and 50 c.c. of the filtrate titrated with  $\frac{N}{20}$  alkali, using methyl orange as indicator.

✂

## Flame Tests of the Alkali and Alkali-Earth Metals

It has been proposed in the *Chemiker Zeitung* to substitute for platinum wire, quartz glass rods, or magnesia spatulae, for the purpose of carrying out flame reactions, the much cheaper and simpler graphite rod to be obtained from any good-quality lead pencil. These rods do not color the flame, glow faintly, and do not melt; while rapid cooling, through dipping into cold solutions, will not cause them to break. The rapidity with which a series of tests can be carried out by cutting or breaking off the end of the rod, and so obtaining a fresh support, is an additional advantage.

✂

Assaying at the West End Consolidated mine costs about 18c. per fusion made. This appears to include all possible charges, and many serve as a basis for bidding on contract work.



## NEW PUBLICATIONS

- COMPRESSED AIR PRACTICE.** By Frank Richards. 6x9 $\frac{3}{4}$ , pp. 326, illus.; \$3. McGraw-Hill Book Co., New York.
- THE AMERICAN FERTILIZER HAND BOOK.** 1913. 8x10 $\frac{3}{4}$ , pp. 352, illus.; \$1. Ware Bros. Co., Philadelphia, Penn.
- ECONOMIC GEOLOGY.** By Charles H. Richardson. 6 $\frac{1}{2}$ x9 $\frac{3}{4}$ , pp. 320, illus.; \$2.50. McGraw-Hill Book Co., New York.
- STEAM: ITS GENERATION AND USE.** 35th Edition. 7 $\frac{1}{2}$ x10 $\frac{1}{2}$ , pp. 335, illus. The Babcock & Wilcox Co., New York.
- O'HARRA'S HANDBOOK OF THE BLACK HILLS.** 4 $\frac{1}{2}$ x6 $\frac{3}{4}$ , 159, illus., paper; 75c. Black Hills Handbook Co., Rapid City, S. D.
- THE MOTOR AND THE DYNAMO.** By James Loring Arnold. 6x9, pp. 178, illus.; \$1.50. Chemical Publishing Co., Easton, Penn.
- FABRICATION DE L'ACIER.** By H. Noble. Second edition, revised. 6 $\frac{1}{2}$ x10, pp. 632, illus., paper; 25 francs. H. Dunod et E. Pinat, Paris.
- TENNESSEE MINING DEPARTMENT TWENTY-SECOND ANNUAL REPORT, 1912.** Pp. 159. George E. Sylvester, Chief Mine Inspector, Nashville, Tenn.
- MECHANICAL REFRIGERATION.** A Treatise for Technical Students and Engineers. By H. J. Macintire. 6x9 $\frac{3}{4}$ , pp. 346, illus. John Wiley & Sons, Inc., New York.
- CHEMICAL GERMAN.** An Introduction to the Study of German Chemical Literature. By Francis C. Phillips. 6x9, pp. 239; \$2. Chemical Publishing Co., Easton, Penn.
- THE CONCRETE HOUSE AND ITS CONSTRUCTION.** By Maurice M. Sloan. 6 $\frac{1}{2}$ x9 $\frac{3}{4}$ , pp. 224, illus.; \$1. Association of American Portland Cement Manufacturers, Philadelphia, Penn.
- THE COPPER HANDBOOK.** Vol. XI, 1912-1913. A Manual of the Copper Mining Industry of the World. By Walter Harvey Weed. 6x9, pp. 1413; \$5. Published by the author at Houghton, Mich., 1914.
- DIE KUPFERHUETTENINDUSTRIE.** Ein Beitrag zu dem Problem der industriellen Standortverteilung. By Ernst David. 5 $\frac{1}{2}$ x9 $\frac{3}{4}$ , pp. 177, paper; 4.50 marks. J. G. Cotta'sche, Stuttgart, Germany.
- VERFAHREN UND EINRICHTUNGEN ZUM TIEFBOHREN.** Kurze Uebersicht über das Gebiet der Tiefbohrtechnik. By Paul Stein. 6 $\frac{1}{2}$ x9 $\frac{3}{4}$ , 25 illus., paper; 1.20 marks. Julius Springer, Berlin, Germany.
- MINERAL RESOURCES OF ALASKA. REPORT ON PROGRESS OF INVESTIGATIONS IN 1912.** By Alfred H. Brooks and others. Pp. 318, illus. Bull. 542, U. S. Geological Survey, Washington, D. C.
- DIE ABHITZKESSEL.** Eine Darstellung der Dampferzeugung mittels Abwärme von Oefen und Hochöfengichtgasen. By F. Peter. 6 $\frac{1}{2}$ x9 $\frac{3}{4}$ , pp. 174, illus., paper; 8 marks. Wilhelm Knapp, Halle a. S., Germany.
- AMERICAN RED CROSS FIRST AID TEXT-BOOK. MINER'S EDITION. A MANUAL OF INSTRUCTION.** By Charles Lynch and M. J. Shields. 4 $\frac{1}{2}$ x7, pp. 186, illus., paper; 30c. P. Blackiston's Son & Co., Philadelphia, Penn.
- DIE QUANTITATIVEN UNTERSUCHUNGSMETHODEN DES MOLYBDANS, VANADIUMS UND WOLFRAMS SOWIE DEREN ERZE, STAEBLE, LEGIERUNGEN UND VERBINDUNGEN.** By Hans Mennicke. 7x10, pp. 231; 8 Marks. M. Krayn, Berlin, Germany.
- METALLURGICAL ANALYSIS.** By Nathaniel Wright Lord and Dana J. Demorest. 5 $\frac{3}{4}$ x8 $\frac{3}{4}$ , pp. 334, illus.; \$2.50. McGraw-Hill Book Co., New York.
- The third edition of a book originally published in 1893, and revised in spots. Intended for students.
- THE HISTORY OF THE E. I. DU PONT DE NEMOURS POWDER COMPANY.** 6x9 $\frac{3}{4}$ , pp. 224, illus., cloth. "Business America," New York.
- This is the history of an important industrial enterprise, which ranks among the oldest of the United States.
- BIBLIOGRAPHY OF SMOKE AND SMOKE PREVENTION.** Compiled by Eliwood H. McClelland. Mellon Institute of Industrial Research and School of Specific Industries, Smoke Investigation Bull. No. 2. 6x9, pp. 164; 50c. University of Pittsburgh, Pittsburgh, Penn.
- An interesting and useful book.
- ALTERNATING CURRENTS AND ALTERNATING CURRENT MACHINERY.** By Dugald C. Jackson and John Price Jackson. New edition; rewritten and enlarged. 6x9, pp. 968, illus.; \$5.50. Macmillan Co., New York.
- A new edition of the authors' treatise first published in 1896, now rewritten and greatly enlarged. A masterly treatise by high authorities.
- PAST AND PRESENT METAL MARKETS.** By W. E. Figgis. 5 $\frac{1}{2}$ x8 $\frac{1}{2}$ , pp. 46; accompanied by chart A, copper and tin; chart B, zinc, lead and silver; board cover; price with A or B chart, 10s. 6d.; with both charts, 15s. Critchley Parker, Melbourne, Aust.
- Notes on the copper, tin, silver, lead and zinc markets from 1890 to present date, with references to present sources of supply and future prospects.
- DIE UNTERSUCHUNG UND BEWERTUNG VON ERZLAGERSTAETTEN.** Second Edition. By P. Krusch. 6 $\frac{1}{2}$ x10, pp. 569, illus., paper, 17 marks. Ferdinand Enke, Stuttgart, Germany.
- The valuable manual of Professor Krusch has passed through two editions within a few years. The author's ob-

ject is to place in the hands of an examining engineer in a condensed form the most important points which he should know. The early pages are devoted to a quick summary of the minerals in orebodies; of the processes leading to their formation; of the shapes, sizes, reliability and the disturbances to which they are subject. The methods of investigation, development, sampling and estimation follow. All this introductory part is covered in 166 pages.

The several metals are then taken up individually, beginning with gold. The special forms of occurrence, the combinations with other elements, the statistics and costs of production are summarized. Even rare elements such as tungsten, thorium, uranium, radium and vanadium are embraced. This portion occupies 277 pages. The remainder of the work is a statistical summary by countries of the ore and metal industry. The European lands come first and are followed by North and South America, Africa, Asia and Australasia. The work is well illustrated and constitutes a useful manual and work of reference.

**FIRST AID IN MINING.** By Louis G. Irvine. 4 $\frac{1}{2}$ x7, pp. 114, illus., paper, 50c. South African Red Cross Society, Johannesburg, South Africa; copies may be obtained from the McGraw-Hill Book Co., New York.

This little book from South Africa is the first of its kind that has come to our attention. "First Aid" books exist in great numbers, but one book written solely from the metal-mining point of view, paying special attention to the methods of treatment that the exigencies of underground work impose, is something that has been long needed. The size, binding and contents of this book leave little to be desired. The usual methods of bandaging for fractures, dislocations, cuts, etc., the prevention of hemorrhage, and the application of tourniquets are described and illustrated. Some good suggestions as to the location and equipment of emergency stations are offered. Of special value are the instructions for handling men in narrow stopes and the descriptions of suitable stretchers, although the woven-wire stretcher that is now common in American practice is not noted. Probably the best chapter in the book is that on poisonous gases, especially those resulting from blasting. The book can be heartily recommended as one which should be in the hands of every man having to do with the operation of mines, from mucker down to manager.

**PRELIMINARY CONCENTRATION TESTS ON MESABI ORES.** By William R. Appleby and Edmund Newton. 6x9 $\frac{3}{4}$  in., pp. 126, illus. Bull. 2, School of Mines Experiment Station, Minneapolis.

Bulletin No. 1 of the Minnesota School of Mines Experiment Station, describing the mining methods followed in the Minnesota ranges, was the best monograph on a strictly mining subject ever published. Bulletin No. 2, entirely different in its nature and much smaller, is probably of quite equal value if somewhat less readable. The former was a record of existing practice and conditions in the iron mining industry of the state. The latter is the report of a large amount of original work on washing Mesabi iron ores. Its value as scientific data is therefore great. A description of standard washing practice as followed on the Western Mesabi and a description of the experimental plant at the station, its purpose, and the object of the report, comprise about all the text of the book. The bulk of the bulletin is made up of the record of tests on 43 ores selected for experimentation. The results are given both in tables and graphically.

It is understood that the function of the experiment station is two-fold: First, to test the susceptibility of various ores to the washing method, which has become standard for the sandy ores; second, to evolve new methods of treatment for such ores as cannot be handled successfully by this standard method. The bulletin under review embodies the results of work along the first line only. When experimentation with new methods has been carried far enough to justify a second report, this should be of greater value yet. There is no more pressing metallurgical question today than the development of commercial methods of preparing low-grade iron ores for furnace treatment, and for no ores is such a method needed more than for the nonsandy, non-magnetic hematites of the Lake Superior ranges, which are cheaply mined, but are just too lean to be merchantable.

The washing tests here recorded were conducted on ores running from 34% to 61% in iron. Recoveries ran from 66% to 97% of the iron in the original. The tailings ran from 15% to 43% in iron. The grade of the concentrates varied from 48% to 65% in iron.

The only possible criticism of the report is perhaps hardly justifiable; it was manifestly impossible to give the name of the mine from which each ore came but the description of its characteristics, while rather detailed, is bound to be wholly inadequate in the attempt to carry any conception of its nature to the outsider.

## Photographs from the Field



THE PACIFIC MINE IN THE MOGOLLON DISTRICT IN NEW MEXICO

High-grade ore was recently opened on the 250-ft. level. Shipments amount to 35 tons of gold-silver ore per day.



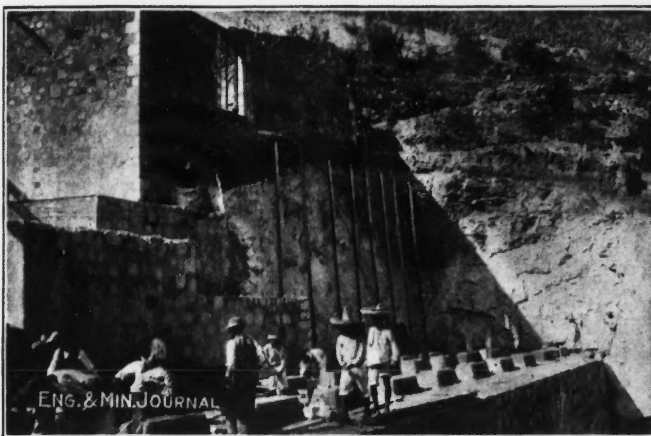
THE ERNESTINE MILL IN THE MOGOLLON DISTRICT IN NEW MEXICO

Mill has crushing capacity of 160 tons per day.

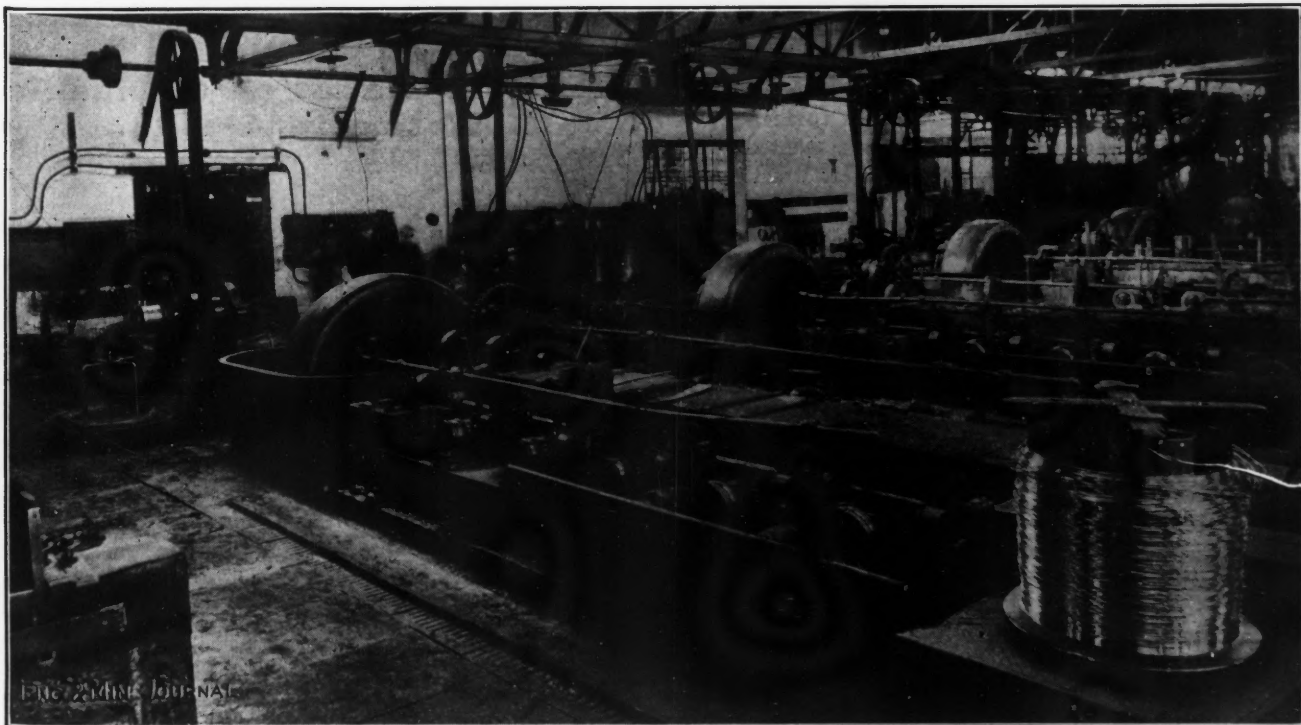




NEW 250-TON STAMP MILL AND CYANIDE PLANT OF CINCO MINAS CO., HOSTOTIPAQUILLO, JALISCO, MEXICO  
 General view of property at left; foundations under construction at right.



WILFLEY TABLE FOUNDATIONS AND MILL FOUNDATIONS FROM CONCRETE MIXING PLANT  
 The Cinco Minas mill was recently completed and has been built despite the political strife in Mexico.



INDIVIDUAL DRIVE COPPER-WIRE DRAWING MACHINES

Rod coil at extreme left; wire coil at right. Wire passes through six dies, rotated by gears on left side of machine. Carrier wheels are successively larger from left to right.

## South African Labor Strikes

LONDON CORRESPONDENCE

A promising strike was organized on the Rand last January. The program was thorough, all work on mines, railways, and public works was to have been stopped. Had it been successful the situation would have been complicated by the necessity of repatriating all the natives, owing to the difficulty of feeding them while railway communications were stopped. The mining industry would have been paralysed for six months at least.

General Botha, Premier of the Transvaal, defeated the strike by calling out troops and commandos of Boer farmers. The latter would probably have been delighted to get a good whack at the miners, mostly Englishmen, as there is no love lost between them.

The nine chief labor leaders were surrounded by troops in the Trades Union Hall. They refused to give in until a 15-lb. field gun was aimed at the building when they unconditionally surrendered and were put into prison.

The nine were aroused from their slumbers some days later, and put into a special train in the early hours of the morning. Under the impression that they were being taken only the few miles to Pretoria, they made no complaints until they awoke to the fact that they were on the way to the coast. They had no opportunity to communicate with anyone until they were safely on board a steamer bound for England. They were then allowed to write to their relations, but it was too late to attempt to get away.

The labor leaders on this side gave them a great reception on their arrival here at the end of February. All nine announced their intention of returning to South Africa but it is doubtful if they would be allowed to land, or would be able to do any damage if they did.

General Botha handled the situation in a masterful way. At the same time it must be noted that there was no venom behind the strike. Its causes are obscure. From the fact that as soon as the agitators were removed the men returned to work without further protest, it appears that the strike was entirely fomented by the leaders and it does not follow that similar drastic methods would check a strike due to low wages and increased cost of living when each individual feels a strong personal grievance.

## Platinum Production in Russia

SPECIAL CORRESPONDENCE

The production of crude platinum in the Ural region in Russia in 1913 showed a considerable decrease according to official figures. The total was 299.45 poods, a decrease of 37.775 poods from 1912. The production as reported for 10 years past has been as follows, reduced to ounces troy. These figures are crude metal, usually taken as 83% platinum:

1904.....	161,197	1909.....	164,513
1905.....	168,343	1910.....	176,020
1906.....	186,674	1911.....	185,529
1907.....	173,500	1912.....	177,515
1908.....	157,051	1913.....	157,630

The production reported in 1913 is the smallest since 1908, and with the exception of that year, is the smallest in the 10 years. Considering that prices during the past year were high, and that there was every inducement

for a large production; and considering also that several dredges were installed in the platinum placers, the conclusion must be reached that the known placers are becoming poorer in yield, and producers are forced to wash sands having a smaller content of metal, which were formerly passed over.

## Brown's Patent Litigation

The Circuit Court of Appeals for the third district has handed down a decision in the case of Joseph A. Vincent vs. Tonopah Mining Co., of Nevada. It will be remembered that Vincent is the present owner of a patent granted in 1905 to Alden H. Brown for a process through which cyanide recovery of the precious metals, as the first step, is followed by concentration. A decision favorable to Vincent was given by the United States District Court, and an appeal was taken by the Tonopah Mining Co. The Court of Appeals reversed the decision of the lower court, and decided that Brown's patent was not infringed.

Vincent, in attacking the Tonopah Mining Co., attempted to maintain that grinding the ore in cyanide solution constituted essentially the cyanide treatment as outlined by Brown, and that the following concentration of the ore practically completed the process, thus following Brown's system. The real treatment by cyanide which follows concentration at the Desert mill, was belittled, and an attempt was made to show that it was unimportant. The court, however, recognized the fact that the cyanide treatment following concentration and regrinding was the real and essential treatment, and that there was no infringement. According to the closing words of the decision, "It is apparent, therefore, that the defendant's device, which the proofs show has been of great practical worth, owes its worth to the fact that it is built and operated in express disregard to the instructions of Brown's patent."

## Mineral Claims on Navigable Waters in Alaska

WASHINGTON CORRESPONDENCE

The decision of the Commissioner of the General Land Office, Oct. 11, 1913, by which the acts pertaining to homesteads and nonmineral claims in Alaska were held to apply to mineral claims as regards continuous extent along the shores of navigable waters, has been reversed on appeal, Feb. 19, 1914. The placer claims of Frances Clarno in the Juneau land district, formed one continuous body of locations extending along the shores of navigable waters approximately 1½ miles and it was first held he could only hold 160 rods along the shore of each entry (group) by leaving 80 rods between. The final conclusion reached by the department is that mining locations and applications and entries whereof, and surveys thereof, in Alaska are not properly to be considered within the scope of the conditions and limitations found in the acts concerning homesteads, etc., located on the shores of navigable waters. The entries involved are accordingly passed to patent.

The Exports of Tin Ore from the United States to Great Britain in the first 11 months of 1913 amounted to 195 long tons, compared with 217 long tons in the corresponding period of 1912. Presumably, this ore was derived, for the most part, from Alaska.



## Correspondence and Discussion

### Miraculous Radium

I trust the JOURNAL editors noted the article by Secretary Lane, published in the *Associated Sunday Magazines* recently. The *Associated Sunday Magazines*, as they no doubt know, is syndicate matter forming the magazine portion of a large number of Sunday newspapers, and according to the publishers, goes into more than a million homes every week. The article that I refer to, in which Secretary Lane uses his title, "Secretary of the Interior," begins as follows:

"When we reflect that the production of every additional half-gram of radium means the saving of a human life a day from the ravages of cancer, no question can remain of our obligation to conserve and make available for use all the radium resources of this country."

Since Secretary Lane must surely know how wildly extravagant the above statement is, it seems remarkable to me that he should publish it. Careful investigation has shown that few cases of cancer have been cured by radium. Indeed, prominent medical authorities insist that not one single case of deep-seated cancer has as yet been cured by it. Eminent European authorities on cancer, who have no appropriation bill to boost, sum up their conclusions in regard to the effects of radium as follows: "Radium is of service in the treatment of cancer through relieving pain in many cases, and appears to have curative effect on superficial cancers of the skin."

Please note how different this is from the statement of Secretary Lane. Please also note that Doctor Kelly is using one gram of radium at his hospital. According to Secretary Lane's estimate, therefore, he should have a record of 700 cures during the past year. Although no definite figures have been given out, I have understood that he claims to have cured seven cases, which is remarkably different from Lane's estimate.

Personally, I believe that this entire radium excitement has been intentionally created and fostered by certain press agents in the employ of a government department. I believe the entire campaign was planned for the one purpose of obtaining an appropriation for a metallurgical plant by the Bureau of Mines.

In such a serious matter as this, it may not seem right for me to call attention to its funny side. However, I cannot refrain from doing so, and so I want to remind the readers that from the testimony before the House Committee, it appears that the earliest producer of radium from American ores was forced out of business by the Post Office Department on a fraud order because he claimed radium to have curative properties. And now just a few years later the Secretary of the Interior publicly refers to radium as a "miracle-worker," and describes its properties as "marvelous," "miraculous," etc.

In conclusion, let me remind the readers that if a medical concern were guilty, in any of its advertising, of making any such assertion as I have just quoted from the opening paragraph of Secretary Lane's paper, it would

no doubt be at once excluded from the use of the mails by a fraud order.

VERITAS.

New York, Feb. 25, 1914.

### The Pittsmtont Shaft Accident in 1913

In the JOURNAL of March 1, 1913, occasion was taken in an editorial to denounce in scathing terms the management of the Pittsmtont mine, charging it with "criminal negligence, callousness, thoughtlessness, or whatever hard name anybody may choose to call it," because as "reported by the local papers nothing was brought out with respect to the existence or nonexistence of a ladderway in the shaft."

Unfortunately the laws of the state of Montana make a mining company specifically liable for the acts of its hoisting engineers and pending the adjustment of claims growing out of this accident my hands were tied in the matter of reply to the editorial cited.

The facts in the case are that Montana statutes and good mining practice demand that shafts be equipped with ladders and that the shaft in question was properly equipped in this particular. All of which may be verified by the transcript of the state mining inspector's testimony at the coroner's inquest. The engine in question was a new machine of approved type, amply large for the purpose.

Sinking was done, not by the common bucket and crosshead method, but by the most approved type of modern sinking cage so equipped with extension shoes that the cage could be run to the bottom of the shaft while the guides reached only to the last set of timber placed. Throughout, the equipment and methods used were in every respect of most modern and approved type, and nothing in the realm of careful, painstaking management was left undone to protect the men against accident.

The accident came about as follows: Nineteen holes had been loaded and were ready for lighting. Five men were in the shaft. The engineer was on the 1200-ft. station some 60 ft. above the bottom of the shaft. The men gave the engineer the customary blasting signal, and he responded in the customary way by raising the cage slightly, and returning it to the bottom. The men were longer than usual in lighting their fuses and the engineer became nervous on this account, and remarked regarding it to a pumpman who was nearby. When the signal to hoist came, he opened the throttle of the engine, but the engine did not more. He became alarmed and shouted to the pumpman referred to that the "air was off," and he was powerless to raise the cage. The pumpman rushed to the shaft and shouted to the men to climb out, that the engine was powerless. Then in his excitement, after rushing about and trying a valve, the pumpman shouted to the engineer to try again. The pumpman was an old man and an old employee in charge of the pumping

plant, and the engineer obeyed his order. The engine worked, and in hoisting the cage through the shaft, two men were brushed off the timber and thrown to the bottom of the shaft and a third was crushed and killed outright by the cage. Two others had retreated into the neighboring compartment, thereby clearing the cage, and these two climbed out of the shaft without any injury whatever, after all holes had exploded. The two men who were thrown to the bottom, crouched upon a projecting ledge at the end of the shaft and by a strange chance escaped with their lives.

The facts as here set down are taken from the coroner's record of his inquiry into the accident. The reason that the engine did not move was that in his anxiety on account of the extra time elapsed, the engineer had failed to release his brake sufficiently to allow his engine to move. And this error of an experienced and always before found competent and faithful employee, was the primary cause of the accident.

The further error of the same man in taking the advice of the pumpman, who was also an old and experienced hoisting engineer, and moving the cage after the men had been told to climb out was the direct cause. The records of the case show that every man was fully out of the range of the blast before the cage was moved, and that the first explosion did not occur until some time after that.

OSCAR ROHN,  
General Manager.

Butte, Mont., Feb. 25, 1914.

[Our remarks respecting this accident, which happened over a year ago, were based upon the reports in the Butte newspapers. We regret that errors in those reports, or in our understanding of them, led us to make comments which appear to have been unjustified and we tender our apologies to the Pittsmtont management. We regret also that our error was not earlier brought to our attention.—EDITOR.]

### Records in All-Steel Dredge Construction

Rudolph E. Schulz, in the JOURNAL of Jan. 17, 1914, claims for the New York Engineering Co. the record in all-steel dredge construction, disputing the claim for the Yuba Construction Co. made in the editorial correspondence under San Francisco date in the JOURNAL, Dec. 27, 1913. I wrote the item referred to and am responsible for the statements made, which I maintain are indisputable.

Mr. Schultz assumes a comparison of a 7½-cu.ft. dredge weighing 675 tons, total, to a 16-cu.ft. dredge weighing 2090 tons, total, claiming that 93 days elapsed time in construction of the 7½-cu.ft. dredge beats the record of four months and four days elapsed time in the construction of the 16-cu.ft. dredge. He might as well compare a 3½-cu.ft. wooden hull boat to a 7½-cu.ft. wooden boat. The record made by Yuba No. 14 all-steel dredge stands, and will stand until a 15-cu.ft. or a 16-cu.ft. or larger all-steel dredge shall be constructed in less time than four months and four days. As to the time referred to by Mr. Schultz for building the Orsk Goldfields, Ltd., dredge (the shop work), I have nothing to say, because my statement was confined to construction in the field.

Regarding the steel deck, my statement that "besides being the largest all-steel dredge in North America, Yuba No. 14 is the only dredge provided with a steel deck" is plain enough. North America does not embrace Siberia—not yet. My item did not state that Yuba No. 14 was the only dredge provided with steel gold-saving tables.

Mr. Schultz says the Orsk dredge was the first all-steel dredge built in the United States; but he does not state when it was built. He might look up the record of the Pato Mines, Ltd., all-steel dredge, built in the United States and shipped to South America, and the two all-steel dredges built in the United States and shipped to Alaska, to the Guggenheims, if he is interested in accurate records of dredge building.

LEWIS H. EDDY.

Oakland, Calif., Jan. 24, 1914.

### Cuban Iron-Ore Titles

I am in possession of the article printed in the ENGINEERING AND MINING JOURNAL of Feb. 14, entitled "Cuban Iron Ore Titles." I do not attach much importance to what is stated there about an old Spanish law 800 years old, according to which, material which can be removed from the surface without mining would not be considered denounceable ores. Such ancient laws have been entirely superseded by more recent legislation.

The oldest mining law or regulation of Spain, of which I have any knowledge, was enacted in 1256, reserving to the King all rights to all ores; but since then many resolutions and laws have been passed, and we need not worry about what the ancient laws said, since the basic law of Dec. 29, 1868, which is now in force, as to the classification of ores, abrogates all previous legislation which is not in accordance with that decree.

The other precepts of the mining law of 1859, amended on Mar. 4, 1868, are declared in force; but that law, in its final section, abrogates all previous laws, instructions and regulations concerning mines. Therefore, the decision to which the JOURNAL refers, of 800 years ago, is decidedly out of existence.

CLAUDIO G. MENDOZA.

Havana, Cuba, Feb. 29, 1914.

### Magnetite Lining for Converters

Early in 1909 basic converting was adopted at the Garfield smelting plant. At first we experienced considerable trouble, due to the forming of excessive amounts of magnetic oxide in the converters. We immediately recognized that if we could control the formation of this material it would prove of considerable value as a protection to the lining. In a short time we were successful in so conducting our converting operations that we were able to control the formation of the magnetic oxide and maintain the required coating or remove it at will. Consequently the practice of coating the lining of converters with magnetic oxide as a protection to the brick has been in successful use at the Garfield plant since 1909, or some two years before basic converting was adopted at Great Falls. I, therefore, cannot see that the patent obtained by Messrs. Wheeler & Krejci will in any way affect the converting practice at Garfield.

W. H. HOWARD,

Garfield, Utah, Feb. 28, 1914. Superintendent.



## Editorials

### Revision of the Mining Law

The agitation among mining engineers and mining operators for a revision of the antiquated mining laws of this land is evidently approaching the stage of fruition, Senator Smoot having introduced a bill for the creation by Congress of a commission to study the matter and report a bill embodying desirable amendments to the present laws. So far, good! However, Senator Smoot's idea of a commission of only three members (one a man of experience in mining, one a mining lawyer, and one a member of the U. S. Geological Survey) and the limitation of study to the metal-mining laws and deposits are not likely to lead to the best results.

Intelligent persons concerned in the mining industry are pretty well agreed that the mining laws of the United States should be revised, but they are by no means agreed even as to the principles upon which the revision should be based. This may be illustrated by recent discussions in the Mining and Metallurgical Society. A committee of the Society headed by Horace V. Winchell, who will be recognized as an eminent authority, engaged in a careful study of this subject, obtaining much evidence and a widely ranging expression of opinion by experts. After several years' consideration, the committee made 10 recommendations, which have been discussed by the Society. Most of the committee's recommendations were approved by the council of the Society, the previous discussions having showed general agreement respecting them. Thus, it was agreed that the mining laws should be revised, not piece-meal, but thoroughly; that mining claims should be locatable regardless of a "discovery;" that the apex law should be abolished; and that the drafting of new laws should be undertaken by a Government commission. There were, however, radical dissents as to the conditions of holding a mining claim after the location and the working of petroleum, phosphates and other mineral lands, and the council considered it necessary to refuse endorsement of the committee's recommendations upon those points and submit the alternatives to the ballot of the membership.

We mention this merely as an indication of the desirability of having a commission large enough to contain a liberal representation of men of experience in mining operations and in the working out of mining laws. Otherwise, it will be difficult to convince the mining communities that their interests are being properly considered. A commission of three, of whom only one must be a person of experience in mining, is certainly too small. We think that members of the U. S. Geological Survey, the U. S. Bureau of Mines, or any other Government bureau, should be excluded from the commission. Let their services be available to the commission, but let the latter be untrammelled by Washington's ideas. The commission should certainly comprise mining lawyers, but it should be chiefly made up, we think, of men who are commercially engaged in mining and who have

had an adequate experience and have obtained positions commanding respect in the industry.

We also believe that the commission should be unrestricted in the scope of its investigations and should be free to cover the entire field of mineral deposits, so that the law finally passed may best coördinate all conditions. The desirability of this is illustrated by one view that is on the ballot of the Mining & Metallurgical Society, which stands for a uniform type of mineral location to cover *all* classes of mineral deposits, location of and title to which shall be subject to the same regulations. This may be a demand that is neither general nor wise, but certainly it should be considered by the proposed commission. Such a consideration would, however, necessitate giving the commission a wider scope than Senator Smoot proposes to allow it.

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### Safety First at Ely, Nevada

It is truly astonishing to what degree the safety-first movement has taken hold in all mining sections of this country and of Canada in the last two or three years. Company after company has organized its safety committee, its rescue team, and its inspection department, and rivalry in this feature of mining practice is becoming as keen as rivalry in production tonnages and costs.

The safety work of the Nevada Consolidated is particularly interesting, since most of the mining operations of this company consist of openpit work, and this, too, carried on under conditions somewhat different from those obtaining in the openpit mines of the iron ranges. Time-honored rules of safety do not apply under these conditions; pioneer work in devising safe methods, and safety regulations is required.

The company issues a book of rules applying to openpit work, printed in three languages besides English, of which the most notable is Greek. A book of rules for an American mine printed in ancient Greek characters is somewhat startling at first glance. At the end of this Greek section of the book is the injunction:

"ΑΠΟΚΤΗΣΑΤΕ ΤΗΝ ΣΥΝΗΘΕΙΑΝ ΤΗΣ ΑΣΦΑΛΕΙΑΣ" which means, "Get the Safety Habit." A philosopher might comment on the application to this purpose of the old and honorable alphabet that has described the highly unsafe exploits of Achilles and Odysseus—but let that be.

In regard to steam-shovel work we note one excellent safety provision, namely, that every shovel be equipped with a distinctively toned steam whistle. Then when any shovel gives the blasting signal every employee in the pit can identify the place where blasting is to be done, and can protect himself or not, as required.

The company furthermore issues a monthly bulletin for circulation among its employees, in which is published miscellaneous material of interest from the safety viewpoint, descriptions of serious accidents occurring about the property during the month, and a complete list of all accidents of whatever nature, classified by depart-

ments. The thoroughness of this last compilation is shown by the fact that over half of the accidents listed are reported as causing no disablement; evidently even the smallest injuries are considered.

The whole-hearted way in which the Nevada Consolidated has taken up its safety campaign is not only highly creditable to the company itself, but indicates the interest that the protection of the mining laborer is arousing in Nevada, as well as in most of the others of our mining states.

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### The Lake Superior Strike

The newspaper reports about opinions of the Congressional investigating committee as expressed informally after its return from Michigan are not auspicious, if they be anywhere near correct. The ideas that have been published indicate that the Calumet & Hecla people are to be held reprehensible, for the reason that having risked a certain sum of money a great many years ago they had the great fortune to reap dividends one hundred-fold or more; and that all the Lake Superior managements are to be blamed for the reason that they will not recognize the Western Federation of Miners, that gentle trades union which fomented the violent strikes in Cripple Creek, Leadville, Telluride, Bingham and the Cœur d'Alene and has left a trail of blood in Colorado, Utah and Idaho.

Much of the evidence submitted before the Congressional Committee was so rank that it is a wonder that even such a committee would listen to it. Thus, as our Calumet correspondent reports, one W. J. Rickard, president of the Calumet local of the W. F. M., testified that in April, 1902, he had worked 26 days at the Osceola and received only \$4.20, when it was shown from the companies' records that he had worked only two days at the Osceola, for which he had received \$4.20, and had finished the month with 21 days at the Kearsarge, receiving \$47.25. Dolphis Little testified that he had received only 27c. for the month of February, 1911, at the Osceola. Accepting his own statement, Little might be regarded as a *peon* indeed, one of those slaves that have been so glibly described. However, Little's record showed an average of \$2.97 per day for the whole of 1911 and \$3.86 per day for 1912, so we cannot feel any great commiseration for him.

In fact, the Lake Superior strike is as good as ended, although the aftermath will be felt for a long while yet and it will be probably some months before the companies will regain their full rate of production, as after such disturbances. It will be a pity if the Congressional Committee makes any report so foolish as the utterances of certain individuals reported in the newspapers.

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### English Mining Capital for the Western Hemisphere

It is interesting to note where much English mining capital is seeking investment these days. A few years ago it seemed that Siberia, Africa, especially outside of the Rand, India, China, the Malay states and Australia would become the most inviting fields, but at present the Western Hemisphere is coming in for a good share of

the attention that a few years ago would naturally have been expected to be turned to the East.

Especially notable is the recent interest displayed by English investors in the Sudbury, Cobalt, Porcupine and near-by districts in Ontario, Canada. Plans for purchases, consolidations and reorganizations have been frequently announced, and the prospects are good for the establishment of several large English corporations for operating newly opened deposits and older proved mines.

In British Columbia copper, lead, zinc, silver and gold properties, having any merit, are being examined or examination is being considered, and while no announcements of the beginning of any large developments by English companies have yet been made, it is within the bounds of possibility that not a little will be heard from that region toward the last of next summer.

In the United States, activity at the Plymouth, in California, farther south, the Pis Pis mines in Nicaragua, and still further south, the presence of prominent English engineers in South America, especially Chile, are the straws indicating which way the wind is blowing. There is a near-to-home ring to these names that is lacking in the recital of the regions which we have formerly been accustomed to associate with expansion in British mining enterprises.

✽

The improvement in sentiment in business which developed in January when money rates fell so sharply, both in America and in Europe, petered out in February and pessimism began again to prevail. The odor of the railway scandals uncovered in 1913 still lingers and the suspicions aroused as to some new ones that might be found out weighed on nerves already strained by long tension. Yet the unexpectedly large increase in the unfilled orders of the Steel Corporation in February, the reduction in the number of side-tracked railway cars, and some other bits of evidence indicate that there is real improvement in business. Over all, however, hang the questions of railway rates and what is to be done about Mexico.

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The decision rendered by the United States Circuit of Appeals for the Third Circuit, in the case of Vincent against the Tonopah Mining Co., is one which will meet with general approval in the world of metallurgy. This concerns the Brown patent issued in 1905, which the lower court decided that the Tonopah Mining Co., at the Desert mill, Millers, Nev., infringed. It is a patent that should never have been issued and would not, had it been examined by anyone skilled in the art. It should never have been upheld by a court, and would not have been, had a technically trained judge reviewed it. Fortunately, the case was so simple and clear that the higher court saw that the ordinary treatment followed at the Desert mill did not infringe upon Brown's rights.

✽

The bill for the creation of an interstate commerce commission, as finally introduced in Congress, appears to be a harmless and may be even a beneficial measure. The threatened horrors of bureaucratic inquisition into private corporate affairs no longer confronts us, and the idea of Governmental regulation of prices has been abandoned. Thus has sanity prevailed.



## BY THE WAY

Government administration is more or less a game of politics, and while with government operation it may sometimes be possible to have efficiency, it will always be impossible to have economy.—(Theodore N. Vail, speaking of government ownership of telegraphs).

☼  
**BULLION FACTORY IN HEART OF RICH** gold district. Send for our prospectus, which is interesting and unique. Company guarantees the return of your money invested. Arapahoe Mining & Milling Co., 218 Colorado Bldg., Denver, Colo.

If money back only is guaranteed, what's the use? If some company would only guarantee return of principal and suitable interest in the meanwhile and would have J. P. Morgan & Co. endorse the guarantee, its offer would be worth considering.

☼  
 The present interest in the crude-oil engine, especially of the Diesel type, recalls the fact that its use in Western mining districts is not new. George J. Young, writing on the history of mining in Nevada, notes that the Midway mill erected in the early days of Tonopah was driven by a Diesel engine, probably the first used around an American mine. This mill, besides following so progressive a method of power generation, was ahead of its time also in its type of construction, which was steel and concrete, whereas in the reduction system followed, it was curiously archaic, Boss pans and the Washoe process being installed. Today, cyaniding is supreme in Tonopah.

☼  
 Archie L. Wisner and John J. Meyers, formerly members of the stock-selling concern of A. L. Wisner & Co., which gathered in several million dollars from poor people to whom it sold oil and mining stocks, were convicted Mar. 13, upon their second trial, and were sentenced each to serve six years in the Atlanta penitentiary, while a fine of \$10,000 in addition was imposed on Meyers. This concludes the cases of this kind that were inaugurated by the last Administration, the Government now having obtained convictions in all of them. In the first trial of Wisner and Meyers the jury disagreed and was dismissed with a scathing rebuke from the judge, who said that on the evidence they should have convicted, as they have been by the second jury. Myers is believed to be still wealthy in spite of the fact that he took the pauper's oath in his home state, California, and was defended by counsel assigned by the court. The authorities believe that Meyers was chiefly responsible for the swindling schemes, while Wisner was the literary expert. Wisner is practically penniless. In another case, Julian Hawthorne and Doctor Morton, who were convicted, have served their sentence in Atlanta, but Albert Freeman, who was convicted along with them, is still fighting for a new trial.

☼  
 We have frequently remarked to the effect that the greatest struggle of the mining company desiring to promote safety measures is not so much with the dangers inherent in the industry, as with the foolishness inherent in the miner. Two incidents reported in the Nevada Consolidated safety bulletin for December, 1913, are cases in point. In one instance, a Greek at the crushing

plant went to get powder, fuse and caps for bulldozing some boulders. He opened a box of 7X caps, then tested a piece of fuse to see whether it would light. It did. Mr. Philis' face was filled with scrap copper from the caps and the sight of one eye endangered. The second case has a more sinister aspect. Complaint was made to the safety department that an incandescent lamp was missing at a dangerous spot in the roaster building. Inquiry of the electric department brought out the fact that it had been stolen, that all lamps put there were stolen and that in three years' time there had been stolen 232 lamps of 100-watt size and 102 of 150-watt, all tungsten. To get them, the thieves would cut the guards and break the locks that were put on them. The theft of these lamps in many cases removed most necessary safety devices, as mean a piece of dishonesty as one often hears of.

☼  
 At the recent annual meeting of the Van Ryn, a Witwatersrand mining company, Mr. Albu, one of the officers apparently, in response to some questions, made the following remarks, according to the *South African Mining Review* of January, 1914:

Several rock drills have been introduced on the Rand, with more or less success, but the question always has been the great cost of maintenance. Those small machines get useless in a short time, and that has proved a great drawback. The rock drills are there, but the cost of maintenance is too great at present. We are trying in one of our mines a new rock drill—the Leyner air drill—of which, up to recently, we have had quite satisfactory reports. I am quite convinced that, sooner or later, a rock drill will be established, because it will be an enormous fortune to the man who invented it, and it will prove a great saving to the companies; in fact, will bring about quite a revolution in the whole industry. Working costs will be decreased, and requirements for capital will go down one-third, and it will do away with that awful question of labor.

We looked carefully at the date of the publication in which this appeared, thinking it might be 1884 instead of 1914, but there seems to be no mistake. And it was only recently that one of the Rand engineers made the boast that Rand practice was the most advanced in the world! They have had "quite satisfactory reports" of the Leyner. So have we, and of the Waugh and of the Jackhamer and of a host of other good American makes and have been having them for many years. Mr. Albu's prescience in expecting that "sooner or later a rock drill will be established," which will result in a fortune to the inventor, etc., does him credit. We also are firm in the belief that the present generation will witness the practical application of steam pumps to mine drainage and we look forward with confidence to the substitution of steam, air and electric hoists for the old *malacate* at the Copper Queen, Miami and other Southwestern mines. The recruiting of sufficient Kafir labor is an ever-pressing problem on the Rand. We suggest a diversion of effort from the recruiting of natives to the recruiting of a few thousand of the able-bodied piston and hammer machines that can be had in this country.

## Ironwood Mine Rescue Car No. 8

### ITINERARY

Arrive	Leave	Company	Address
Mar. 16	Mar. 21	Verona Mining Co.	Palatka, Mich.
Mar. 23	Apr. 4	Davidson Ore Mining Co., Monroe Mining Co., and others.	Iron River, Mich.

## PERSONALS

T. Burns McGhie is now resident at Bongate House, Appleby, Westmoreland, England.

L. F. S. Holland is examining mines in Arizona and expects to return to Los Angeles shortly.

Hugh G. Elwes, who has been visiting in New York for several weeks, has returned to Mexico City.

A. E. Drucker has established his office as consulting engineer at 62 London Wall, London, England.

H. H. Knox sailed on Mar. 18, for Colombia, and will be engaged on professional work there until May.

Alfred W. Calloway has been elected president of the Davis Coal & Coke Co., in place of J. M. Fitzgerald, resigned.

Richard A. Parker has moved his office as consulting mining engineer to 802 Equitable Building, Denver, Colorado.

J. J. Keating has been appointed efficiency engineer of the Copper Queen Consolidated Mining Co., at Douglas, Arizona.

C. J. London has gone to Colombia. His address for the next four or five months will be "Care Empressa Hanseatica, Barranquilla, Republic of Colombia."

W. de L. Benedict left New York on Mar. 18, for California and other Western states, where he will be engaged in professional work for about two months.

A. MacKinnon, of New York, who is largely interested in the Elizabeth gold mine and other properties, was recently in Fort William, Ont., looking after his interests.

Lawrence Addicks, superintendent of the copper refinery of the United States Metals Refining Co., sailed from New York for Liverpool, Mar. 16, to be gone three or four weeks.

Edw. C. O'Keefe has resigned his position as professor of chemistry and metallurgy at the State School of Mines, Weir, Kan., and has accepted a position with the Federal Lead Co., at Flat River, Missouri.

Severin Letourneau, of Montreal, who represents Hochelega County in the Quebec Legislature, has been appointed Minister of Colonization & Mines for the province of Quebec, to succeed C. R. Devlin, deceased.

Dr. Elliott, a well known oil expert, John W. Phillips and Col. J. S. Fenn have returned to Edmonton, Alta., after a month's trip to the district north of Fort McMoorey, Alta., and are arranging for development of oil claims in that region.

## OBITUARY

Charles C. Briggs, 34 years old, recently engaged as a mechanical engineer in California and at one time identified with the steel trade at Pittsburgh, died suddenly, Mar. 9, at Chicago. He was the son of the late C. C. Briggs, a well known member of the organization of the Jones & Laughlin Steel Co., Pittsburgh. After being graduated from the Massachusetts Institute of Technology, in 1900, Mr. Briggs became identified with the engineering department of the Jones & Laughlin company, and later was associated with the National Tube Co. and the Carnegie Steel Co., at McKeesport and Sharon.

W. Q. Ranft died at New York, Mar. 12. He was born in Baltimore in 1869 and left his home at the age of 16 to study law in New York and in the West. He was for several years connected with the Government in the administration of Indian lands, and later became interested in mining properties. Up to a few months ago he was president of the Iron Mountain Tunnel Co. and the Robert Emmet Copper Co. Mr. Ranft was, in all of his promotion enterprises, influenced by the highest motives, and left a great many friends in the mining profession who were devoted to him on account of his steadfastness and his manly character.

Louis Janin, for many years one of the best known mining engineers on the Pacific Coast, died at Santa Barbara, Calif., Mar. 6, aged 75 years. Born in New Orleans, he went to San Francisco over 40 years ago and from that time on was connected with many well known mines in California, Nevada and other states, as well as in British Columbia and Mexico. Many prominent mining engineers owe much of their early training to him. In addition to his work as an engineer, he wrote several textbooks on mining and contributed fre-

quently to periodical literature. He retired from active practice about 10 years ago, living at his ranch in the Santa Ynez Valley; but was much in demand as consulting engineer and as an expert witness in mining suits. He was one of the oldest members of the American Institute of Mining Engineers. His brother, Henry Janin, who died several years ago, was also a well known mining engineer, as is his son, Charles Janin, now in Russia, and his son, Louis, Jr., who retired on account of ill health some years ago. Mr. Janin's remains were cremated and will be sent to New Orleans for final interment.

George Westinghouse, inventor of the air brake, electrical and mechanical engineer, president or director of 22 companies with works in all parts of the world, died at his home in New York on Mar. 12. The life of Mr. Westinghouse may be characterized as a struggle and triumph over what the world called impossibilities. He was born in 1846 at Central Bridge, Schoharie County, New York. His father was a manufacturer of agricultural implements, and in his shop, which is still in operation in Schenectady, the younger Westinghouse received his first mechanical training. When he was only 15 years old he constructed a rotary engine; he was interested all his life in rotary-engine problems. In 1863 he enlisted and served through the war in the navy-engineer corps. His first patent was that for a device for replacing derailed cars on the track, and it was while developing this business that he conceived the idea of the air brake with which his name will always be associated. He was only 22 when in 1867 the air brake proved a success, though it took time to show the railways what an enormous factor it was in successful operation. Later he engaged in the electrical business, after spending some time in introducing improved signal systems. To him was due the successful introduction of the alternating-current system. In 1885 he bought the American rights of the Goulard and Gibbs patents, which covered the first alternating-current machinery. Later he induced Tesla to come to Pittsburgh and there make his induction motors. And in 1890 the Westinghouse Co. built the first two alternating-current motors in America, which proved enormously successful. He was a many-sided man and a most prolific and versatile inventor. Among what may be called his minor activities are the utilization of natural gas in the Pittsburgh district, the foundation of the Westinghouse Machine Co. for the construction of high-speed steam engines, the development of the Parsons turbine, and of air springs for motor vehicles. He was a member of the French Legion of Honor, of the order of the Iron Crown of Italy, and had been decorated by King Leopold, of Belgium. Union College years ago made him a Ph.D. The Royal Technical High School, of Berlin, gave him the degree of Doctor of Engineers. He was an honorary member and past president of the American Society of Mechanical Engineers. He was the second recipient of the John Fritz Medal, and in 1913 he received the Grashof Medal from the Verein Deutscher Ingenieure. He was also an honorary member of the American Association for the Advancement of Science and of the National Electric Light Association, and in 1912 received the Edison Medal awarded by the American Institute of Electrical Engineers.

## SOCIETIES

**Colorado Scientific Society**—The 301st regular meeting of the Colorado Scientific Society was held in the Boston Building, Denver, Mar. 7. The address of the evening was "Notes on the Geography and History of Denver" by Professor George L. Cannon. This was a very interesting paper.

The Society tendered a reception and dinner to Dr. Livingston Farrand, the new president of the University of Colorado, on Thursday evening, Mar. 12, at the University Club, Denver.

**American Institute of Mining Engineers**—The St. Louis section of the Institute held its first meeting on Feb. 28, at the St. Louis Club, at which bylaws were adopted and the following officers were elected for the ensuing year: H. A. Wheeler, chairman; F. V. Desloge, vice-chairman; W. E. McCourt, secretary and treasurer; P. N. Moore, J. W. Malcolmson, R. A. Bull, directors. It was decided to hold two meetings a year, one to be a social affair with papers and the other a field excursion. There were 34 members present, with Bradley Stoughton, the Secretary of the Institute, and Jas. R. Finlay as guests. The meeting was preceded by a very enjoyable banquet that was presided over by P. N. Moore as chairman and with Arthur Thacher as toastmaster. Informal



papers were presented by Mr. Finlay on "Lead Mining in Southeastern Missouri," by Mr. Thacher on "Economy in Mining" and by Mr. Malcolmson on "Mexican Mining under Present Conditions."

## INDUSTRIAL NEWS

The Knox Manufacturing Co., Inc., announces its removal to its new office, 821 Cherry St., Philadelphia, Penn.

Northern Electric Co., Ltd., of Montreal, Canada, begs to announce that it has acquired the business and undertakings of Imperial Wire & Cable Co. Ltd., and the Northern Electric & Mfg. Co., Ltd.

The Terry Steam Turbine Co. has acquired from the Rateau Steam Regenerator Co., of 140 Cedar St., New York, N. Y., a license to manufacture mixed pressure turbine regulators under Rateau United States letters patent.

The Hardinge Conical Mill Co., of 50 Church St., New York, reports that the California Exploration Co. has decided to install two Hardinge pebble mills, 8 ft. in diameter with 22 in. cylindrical section at the new Plymouth plant.

The necessity for larger space and better facilities to handle their increased business compelled the Indianapolis, Ind., and Louisville, Ky., branches of the H. W. Johns-Manville Co. to seek larger quarters. The new address of the Indianapolis branch is 408-410 North Capitol Ave.; that of the Louisville branch, 659-661 South Fourth Avenue.

The Asbestos Protected Metal Co., of Beaver Falls, Penn., is marketing a new form of prepared roofing which they have named Aegisroll. The body or base of this roofing is water-proofed wool felt, completely enveloped in a coating of asphalt compounds. To the upper surface of this base is attached pure asbestos felt, while the lower surface is protected by a coating of crushed quartz. Both the asbestos and the crushed quartz are embedded into their respective surfaces while the asphalt is hot and they are therefore permanently attached. Aegisroll roofing can be furnished in a variety of colors.

General Electric Co., Schenectady, N. Y., reports the following orders; from the Butte Duluth Mining Co., Butte, Mont., a 1250-kv-a. two-unit three-bearing synchronous motor-generator set, three 150-kv-a. transformers and a switchboard, also seven motors ranging from 5 hp. to 150 hp.; the Utah Copper Co., four 2500-kv-a. water-cooled transformers, the Arizona Copper Co., Clifton, Ariz., a 150-kw. 250-volt synchronous converter, three 60-kv-a. transformers and switchboard panels; the Smuggler Leasing Co., Aspen, Colo., two 125-hp. motors and a switchboard panel; the Old Dominion Copper & Smelting Co., Globe, Ariz., a 225-hp. induction motor; the East Butte Copper Co., Butte, Mont., a 150-hp. induction motor; the Essanbee Mines Co., Clinton, Ind., one 4-ton electric and two inside frame storage battery locomotives; the Cornucopia Mines Co., Cornucopia, Ore., two 75-hp. motors and controller; the Anaconda Copper Mining Co., Butte, Mont., one 35-hp. and three 75-hp. motors.

## TRADE CATALOGS

American Concentrator Co., Philadelphia, Penn. Catalog. 16 pp., illus. 9x5½ inches.

Northern Engineering Works, Detroit, Mich. Catalog No. 26. Cranes. 64 pp., illus. 6x9 inches.

Allis-Chalmers Manufacturing Co., Milwaukee, Wisconsin. Bulletin No. 1451. 16 pp., illus. 10½x8 inches.

Sauerman Bros., 1139-41 Monadnock Block, Chicago, Ill. Catalog. Shearer & Mayer dragline cableway excavator. 48 pp., illus. 6x9 inches.

National Tube Co., Frick Building, Pittsburgh, Penn. "National" bulletin No. 15A, second edition. "National" pipe for drilling purposes. 8 pp., illus. 11x8½ inches.

The Monarch Engineering & Manufacturing Co., 1200-1206 American Building, Baltimore, Maryland. Catalog Monarch modern melting and refining furnaces and foundry equipment. 12 pp., illus. 3½x6 inches.

Dorr Cyanide Machinery Co., Denver and New York, has issued a catalog, No. 5-A, which gives latest data of Dorr machinery, including classifiers, thickeners and agitators. The New York office of this company is at 50 Church St.

## NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each British patents are supplied at 40c. each.

**ALLOY**—Process of Making an Iron-Nickel-Copper Alloy. Guillian H. Clamer, Philadelphia, Penn. (U. S. No. 1,086,314; Feb. 3, 1914.)

**ALLOYS**—Improvements in and Relating to Nickel-Copper Alloys. P. J. A. Douglass, Dartmouth, Canada. (Brit. No. 8331 of 1913.)

**ALUNITE**—Method of Calcining Alunite. Howard F. Chappell, New York, N. Y. (U. S. No. 1,089,109; Mar. 3, 1914.)

**BRIQUETTING**—Process of Preliminarily Treating Mineral and Metallic Substances Which Are To Be United by Pressure. Arpad Rónay, Berlin, Germany, assignor, by mesne assignments, to General Briquetting Co., New York, N. Y. (U. S. No. 1,087,183; Feb. 17, 1914.)

**CONCENTRATING ORES**—Apparatus for. William F. Deister, Fort Wayne, Ind., assignor to Deister Machine Co., Fort Wayne, Ind. (U. S. No. 1,088,685; Mar. 3, 1914.)

**CONCENTRATING TABLES**—Head-Motion for. William F. Deister, Fort Wayne, Ind., assignor to Deister Machine Co., Fort Wayne, Ind. (U. S. No. 1,088,682; Mar. 3, 1914.)

**CONCENTRATING UNITS**—Mechanism for Operating. William F. Deister, Fort Wayne, Ind., assignor to Deister Machine Co., Fort Wayne, Ind. (U. S. No. 1,088,683 and 1,088,684; Mar. 3, 1914.)

**CONCENTRATOR (DRY)**—Means for Separating Heavy and Light Comminuted Materials. James D. Nairne, Alhambra, Calif., assignor to Claude T. Adams, Alhambra, Calif. (U. S. No. 1,088,443; Feb. 24, 1914.)

**CRUSHER**—Gyratory Rock Crusher. Ajay Washburne, Fruitvale, Calif. (U. S. No. 1,087,204; Feb. 17, 1914.)

**CRUSHING**—Improvements in Mills for Grinding, Crushing, Pulverizing, Separating or Mixing Materials. Edgar Allen & Co., Ltd., Sheffield, Eng. (Brit. No. 5069 of 1913.)

**DRILLS**—Rock Drill. Hans Edgar, Karangahake, New Zealand. (U. S. No. 1,088,334; Feb. 24, 1914.)

**DRILLING**—Rock-Drilling Machine. Franz Bade, Peine, Germany. (U. S. No. 1,087,706; Feb. 17, 1914.)

**DRILLING**—Rock-Drilling Machine. William S. Benjamin, Seattle, Wash. (U. S. No. 1,087,632; Feb. 17, 1914.)

**DRILLS**—Improvements in Rock Drills. J. M. and J. L. Holman, Camborne, Cornwall, Eng. (Brit. No. 1610 of 1913.)

**FLOTATION PROCESS**—Ore Concentrator. Henry Ellsworth Wood, Denver, Colo. (U. S. No. 1,088,050; Feb. 24, 1914.)

**FLUME**—Metallic Flume. Julius H. Schlafly, Canton, Ohio. (U. S. No. 1,087,325; Feb. 17, 1914.)

**GARNET**—Method of Producing Abrasive Compounds. Thomas B. Allen, Niagara Falls, N. Y., assignor to the Carborundum Co., Niagara Falls, N. Y. (U. S. No. 1,087,705; Feb. 17, 1914.)

**HOISTING**—Safety Lock for Self-Dumping Mine Cages. William J. Phelan, New Salem, Penn. (U. S. No. 1,085,297; Jan. 27, 1914.)

**HYDROMETALLURGY OF COPPER**. Edward Ray Weidlein, Pittsburgh, Penn., assignor, by mesne assignments, to Metals Research Co., New York, N. Y. (U. S. No. 1,089,096; Mar. 3, 1914.)

**LAMP**—Miners' Acetylene Lamp. Ulysse Daubresse, Novinger, Mo. (U. S. No. 1,087,645; Feb. 17, 1914.)

**MINE CAR**. James J. Roby, Cleveland, Ohio. (U. S. No. 1,087,318; Feb. 17, 1914.)

**MINE CARS**—Means for Uncoupling Mine Cars. George P. Payne, Liberty, N. C. (U. S. No. 1,087,976; Feb. 24, 1914.)

**MINERAL DETERMINATION**—Chart for Use in Determining Minerals and Other Substances. Vachel H. McNutt, Rolla, Mo. (U. S. No. 1,087,174; Feb. 17, 1914.)

**ORE SAMPLER**. Charles H. Urquhart, Newark, N. J., assignor of one-half to Charles E. Knox, San Francisco, Calif. (U. S. No. 1,088,638; Feb. 24, 1914.)

**PLACER MINING**—Apparatus for Treating Placer. Carl E. J. Anderson, Youngstown, Ohio. (U. S. Nos. 1,088,759 and 1,088,760; Mar. 3, 1914.)

**POTASH**—Process of Obtaining Potash Salts from Kelp. Harry Wilson, San Francisco, Calif., assignor to Pacific Kelp Co., San Francisco, Calif. (U. S. Nos. 1,087,477 and 1,087,478; Feb. 17, 1914.)

**PROTECTING SCREEN** for Metallurgical Furnaces. Francois Corin, Sclaigneaux, Belgium. (U. S. No. 1,087,529; Feb. 17, 1914.)

**SEPARATOR**—Ore Separator (Dry). Francis J. Hobson and Charles E. Beyer, Nogales, Ariz. (U. S. No. 1,085,256; Jan. 27, 1914.)

**STEEL**—Treating Steel in Electric Furnaces with Basic Hearths. William R. Walker, New York, N. Y. (U. S. 1,086,489; Feb. 10, 1914.)

**SULPHUR**—Improvements in and Relating to the Manufacture and Production of Sulphur and Sulphates from Sulphites. F. Bayer & Co., Leverkusen, near Cologne, Germany. (Brit. No. 28,820 of 1912.)

**TIN**—Obtaining Tetrachloride of Tin from Tin Scrap and Other Materials Containing Tin. Paul Wolff, Wetzlar, Germany, assignor, by mesne assignments, to Vulcan Detinning Co. (U. S. No. 1,087,522 and 1,087,523; Feb. 17, 1914.)

**ZINC**—An Improved Process and Apparatus for the Condensation of Vapors of Volatile Metals, especially Zinc Vapor. F. G. W. Timm, Hamburg, Germany. (Brit. No. 1701 of 1913.)

## Editorial Correspondence

### SAN FRANCISCO—Mar. 11

The California Industrial Accident Commission is organizing a department of safety. The need of such a department is to be considered at a conference in San Francisco, Mar. 13, which will be addressed by Governor Johnson and Senator A. E. Boynton. It is expected that operators and owners of some of the large mines will take part in the conference. The commission, in extending invitations to attend the conference, states that in 1913 there were 823 deaths and 36,462 industrial accidents in California; that 514 accidents were reported for Mar. 2, 3 and 4. These figures include deaths and accidents in all industries. The conference will no doubt attract the interest of mining men, not only to the need of some definite action by the state in support of the effort being made by the Bureau of Mines in connection with the state accident commission, but will create a greater interest in the necessity for modifying some of the laws relating to mining. With few exceptions the mine operators of California are diligent and careful regarding the welfare of underground miners; but the demands of the workmen's compensation law have recently roused a larger interest in their own welfare. Mine owners and operators, who are disposed to carry on their work with regard for the safety of the workmen, have been inclined to disregard the necessity of interesting themselves in making the laws. It has required the effects of inadequate and inconsistent laws to awaken some of the more prominent mine owners to the demands of community interests, so the men who are disposed to conduct their own operations with due regard for their employees are now desirous of imposing the same requirements upon the careless operators that have been voluntarily obeyed by the careful operators. Had they taken such interest in the affairs of their neighbors earlier there would have been no occasion for the drastic demands of the workmen's compensation law, in its application to the mining industry.

### BUTTE—Mar. 11

The Anaconda's New Slime Plant at the Washoe works at Anaconda, says E. P. Mathewson, general superintendent of the Anaconda Copper Mining Co., will be half completed Mar. 15, and the completed half will be put in operation. Construction of the round tables and the dewatering plant has been practically completed, and water has been turned in to most of the large tanks in the Dorr thickener division. With the plant running at full capacity a force of about 45 men will be employed in this department.

### DENVER—Mar. 12

The Congressional Committee that has been in Colorado for several weeks investigating the coal-strike conditions completed its task and left for Washington Mar. 8. While the committee has no authority to settle the troubles here, it seems certain that it will make recommendations to Congress for the enactment of new laws covering some, if not all, of the following. The prohibition of the sale or shipment of firearms and ammunition for use by participants in industrial conflicts; the prohibition of the employment of professional "gun-men" and "agitators"; the compulsory incorporation of organized labor bodies; the appointment of a national arbitration committee to settle industrial conflicts; prohibition of post offices on property controlled by mining companies; compulsory employment of check weighmasters to be selected by the miners; provision for better safeguards against accidents; prevention of importing strike-breakers, with special reference to peonage; and the separation of corporation and political activities. "Mother Jones" was not officially interviewed as was expected. Whereas the members of the committee have worked harmoniously in securing the facts, it seems probable that there may be majority and minority reports submitted with reference to a few points. It will be Apr. 1, perhaps, before a full transcript of the testimony can be made and the reports formulated. Affairs were quiet in the strike regions during the stay of the committee in the state, but a small tempest has arisen since. For alleged connection with the brutal murder of a negro strike-breaker, civil authorities arrested 13 strikers of the Forbes tent colony. It is claimed these men were trailed by bloodhounds. The militia then razed all but two of the tents and

ordered the remaining inhabitants to vacate within 48 hours. Union officials declare they will advise every striker to arm himself to defend his home. General Chase says his troops have confiscated more firearms from miners. The members of the committee have been wired the Union side of the controversy by John R. Lawson. The end is not yet.

### SALT LAKE CITY—Mar. 12

The Leasing System Adopted by the Gemini at Tintic during the last two years has been successful, and the company is again one of the heaviest shippers in the district. Lessees are allowed the free use of the company's machine drills and no charge is made for the use of air in prospecting or for hoisting waste. After ore has been found the lessees pay for the air, and for hoisting ore. During the last year approximately 20,000 tons of ore were mined, about a third of the value of which, or \$170,000 was distributed among the lessees. They are largely miners of the Tintic district, and are able to make wages or better under this system. Dividends of \$10 per share on 5000 shares were paid by the company in May and November, 1913.

### CALUMET—Mar. 14

The Congressional Committee has completed its investigation into the Michigan copper strike and has returned to Washington. The committee spent about four weeks in the district; three weeks were taken up with the testimony and evidence submitted by the Federation and after this was in, the committee seemed particularly anxious to wind up the sessions and gave the mining companies a week in which to present their side, although the companies had several hundred additional witnesses to place on the stand. The committee spent a few days in Chicago and gave Moyer an opportunity to get into the records without coming into Michigan, where he is under indictment. A statement made by Moyer in Chicago, to the effect that he would agree to have the men make their own terms in regards to returning to work, even to the extent of turning in their membership cards to the Federation, caused quite a flurry locally, but the officials of the locals maintain that the situation remains unchanged and the men will continue to stand by the Federation. It is persistently rumored that the benefits are being reduced and that some of the local agitators have been dropped from the pay-roll. Funds are not coming in fast and only in comparatively small amounts. Former employees are returning to work daily and many of those who are remaining out, are doing so for the simple reason that they would rather live on the small amounts they receive in the way of benefits than go to work. All the producing mines are practically operating at normal capacity and nearly all the smaller companies have resumed operations or are unwatering preparatory to resuming. At the Mohawk where the strikers were particularly strong, production is being rapidly increased and about 1800 tons per day are being mined, and it will be only a short time until it is back to normal.

### HOUGHTON—Mar. 12

Present Conditions in the Copper Country do not indicate that a strike is still in progress. During February the tonnages on the railroads that haul the copper rock from the mines to the stamp mills showed a greater total than any February record in the history of the district. During the progress of the recently concluded Congressional investigation the strikers gave a parade. It was the first one in many months. It was largely made up of Finnish socialist farmers, who were gathered in from all the surrounding districts for the purpose. Their identity as farmers was established by the shoe packs they wore. The parade was arranged for the benefit of the committee in the court house. That purpose failed because, while the strikers marched by the county building, the committee knew nothing of the demonstration until they read it in the newspapers. The Federation failed utterly in its efforts to make out a case. That is acknowledged by all sides, by all observers. The resolution under which the committee was instructed to come to Michigan to investigate the strike specifically asked that six alleged conditions be inquired into. These included peonage, postal service interference, immigration violations, unconstitu-



tional acts, restraint of trade and importation of firearms. While the Federation lawyers took three weeks they failed to prove their case or to establish any violation of any Federal statute in any one of the six specifications. Attorney Rees, in his opening statement, said that if the committee was a jury and the case at law he would rest with the presentation of no evidence, but inasmuch as the publicity features seemed to be the basis for the whole action he asked opportunity to present witnesses. The most important witness for the mining companies was James MacNaughton, manager of the Calumet & Hecla. He was on the stand for the greater part of three days and gave testimony on Lake Superior copper mining which was in itself a liberal mining education on methods and practices in the mines of Michigan. Even Hilton, the attorney for the Federation, acknowledged after the hearing that he was the best witness he had ever questioned. Hilton's attempt to grill MacNaughton was a dismal failure. For three days following MacNaughton the mining companies put on witness after witness to prove the falsity of the Federation charges. Many men told of their work and their satisfaction with their jobs and their pay. The last few days of the investigation was a continuous tale of strike violence, dynamiting, slugging, stoning trains, beating up old men, preaching violence and socialism, impeachment of witnesses who alleged unfair treatment; false affidavits laid before Congress to bring about the investigation; and the general lawless tactics employed by the Federation wherever it is engaged in a strike. Then the committee, after giving the strikers three weeks, limited the companies to less than one week and insisted on finishing on Saturday night in order to be in Chicago on Monday. The mining companies had 1600 witnesses who got no chance to testify. Moreover the committee adjourned to meet in Chicago for the accommodation of Moyer, head of the Western Federation. Moyer dared not return to Michigan because of the charge against him, but the Congressional committee went to Chicago to suit him. Further evidences of the "fairness" of the committee was shown in the manner of investigating the Italian Hall disaster. Two members went to Calumet, heard the 10 trained witnesses testify to their various views of the disaster, all insisting that the Citizen's Alliance was responsible and heard not one of the other 50 witnesses who testified at the coroner's inquest and who insisted that the cry came from within the hall and there were none but men with union cards admitted to the hall. After hearing this testimony the congressmen would not even agree to put in the record of the inquest, nor even the verdict of the coroner's jury. Congressman Casey, one of the members of the committee, in reality acted as attorney for the Federation all through the investigation and he was generally assisted by Chairman Taylor of the committee. Casey was frank and above board in his attitude in favor of organized labor. The general impression here is that no report will be made.

#### JOPLIN—Mar. 14

**Plans for the Panama-Pacific Exposition** were talked over at a meeting of the mine operators and citizens of Joplin. Director Van Barneveld outlined the plans now under way for the exhibits of minerals and the mineral industries. In company with John L. McNatt, the chairman of the Missouri exposition committee, he asked for suggestions for an exhibit from Missouri and urged the mine operators to support a liberal exhibit and to make such a one as would be highly educational and attractive. Director Van Barneveld made several suggestions and pointed out that as Missouri was the leading zinc- and lead-producing state, he would depend upon Missouri to supply the best exhibits of the lead and zinc mining industries. Following the discussion, an organization was perfected with Judge Clark Craycroft as chairman and Walter Ragland as secretary to undertake the stimulation of local interest in the mineral exhibit. When the Missouri commission gets ready to submit its plans the local organization will hold itself ready to offer its assistance in obtaining exhibits and data of interest.

**Western Federation of Miners' Activity** in the Joplin district has just been further evidenced by the demand to work surface employees only 8 instead of 9 to 12 hours depending upon the character of the work. It appears that for many years the milling conditions of the field have been upon the basis of a 10-hr. shift for the mill hands with 12-hr. shifts for engineers and firemen. Underground men have been worked only 8 hr. Since the entrance of the Western Federation to the field the organizers have dug up an old Missouri state law which requires that all employees either underground or surface must not be worked more than eight hours per shift. The attention of the Missouri state mine inspectors has been forcibly called to this law and they have been asked to rigidly enforce it. In addition to this the Federation officials have called upon the state attorney-gen-

eral to call for the enforcement of the act. Investigation of the statute seems to prove it entirely legal and there is no other alternative to the state officials but enforce the measure, although it means total disorganization of the lead and zinc mining industries of the state. Economical mining practice in the Joplin field has been built up on the principle of one shift in the ground to run two shifts of the mill, and make the unit of operation as large as possible from a tonnage standpoint. Hence two shifts in the mill meant 20 hr. out of every 24 for actual milling and the other four for repairs. Under the enforcement of the 8-hr. law 4 hr. per day are lost to the operator or 20% reduction in his capacity has taken place with no reduction in the cost of his labor. By introducing a three-shift system the capacity of the plant is kept up, but the cost of operations has increased 33% for labor with no corresponding return in output of ore. Already skating on thin ice on account of the low price of ore the mine operators have had an added burden put upon them that is not yet showing signs of being lightened in any manner. Just what steps will be taken has not yet been determined, but it is likely that one mining company will be selected to make a test case upon the matter by court procedure. It is understood that the mine operators will hold a meeting soon to discuss the situation. In the meantime the Federation organizers are busily engaged in securing members and strengthening their local union.

#### MARQUETTE—Mar. 14

**The Arctic Iron Co. Case** has been decided recently by United States Judge C. W. Sessions, of Grand Rapids, in favor of the plaintiff. The equity case of the Arctic company vs. the Cleveland-Cliffs Iron Co. and William G. Mather, of Cleveland, its president, will now go to the Federal Court of Appeals at Cincinnati. Notice to this effect has been given by A. T. Dustin, of Cleveland, of counsel for the defendants. The case is one of the most important that has ever arisen in the Lake Superior iron region. It involves valuable mining property at Negaunee, on the Marquette range, now worked by the Steel Corporation. Judge Sessions awarded the plaintiff the amount fixed by the master in chancery, whose findings the court sustained in full. The case in the appellate tribunal will be argued within three to six months. The decision of Judge Sessions is perhaps the most important yet handed down in the Michigan mining industry. The monetary judgment, which dates to Apr. 25, 1913, and totals \$899,403 will, in the event of a final victory for the plaintiff, be increased by all the profits that may accrue subsequent to that date. In addition, the decree as it now stands awards to the Arctic company one-fourth of the capital stock of the Regent Iron Co.; one-sixteenth part of the fee of the Regent group at Negaunee, including the Queen, Blue and Prince of Wales, and one-fourth of all the future profits to be derived from the operation of those properties under the Steel Corporation's lease of January, 1899. However, if finally defeated, the Cleveland-Cliffs company will be a loser by only half of the amount of the damages, the stock of the Arctic company being held equally by that corporation and the E. N. Breitung interests of Marquette. A lease of the Regent group of mines by the Arctic company, owner of the major part of the fee, to the Oliver Iron Mining Co. is the matter in litigation. William G. Mather, president of the Cleveland-Cliffs company, was a trustee of the Arctic company when the lease was made, and it is the contention of the Breitung interests, in behalf of the Arctic company, that under the provisions of the lease the Cleveland-Cliffs company reserved advantages which should have been shared with the Arctic company. The case was disposed of in the U. S. district court in 1909, when Judge Knappen, Judge Sessions' predecessor, rendered a decision for the Arctic company. John B. Lawrence then was appointed master to determine the amount of the damages, and his report was made to the court last autumn. His findings recently were sustained in every particular by Judge Sessions. The defendants now seek to have the interlocutory decree reopened, this having been entered in 1909.

#### COBALT—Mar. 14

**The English Amalgamation of Cobalt Companies** includes the Cobalt Townsite, 40 acres, capital \$1,000,000; Cobalt Lake, 49 acres, capital \$3,000,000; City of Cobalt, 47 acres, capital \$2,100,000, and Townsite Extension, 18 acres. The Northern Customs concentrator which was purchased some time ago to treat Townsite and City of Cobalt ore, will also be included. The proposed capital of the new company is \$7,500,000. In order to centralize the workings, a new main shaft in close proximity to the concentrator has been started on the Townsite property. This shaft will have two hoisting compartments and will tap five levels. The shaft will be equipped with a steel headframe.

# The Mining News

## ALASKA

**TESTING PLANT IN KETCHIKAN DISTRICT** is object of representations now being made to Bureau of Mines.

**PLACER TIN IN SULLIVAN CREEK**, in Rampart district, has been found with placer gold. Tin is smoothly rounded pebbles of cassiterite, or oxide of tin, and area in which tin is found is less than a mile long. Half pound of tin has been found in one pan in the richest spots.

**REPORT OF A NEW CHISANA STRIKE** has just come in, it having been made on high benches and has again aroused stampede excitement along the coast of Alaska. It is now thought that there will be another "Gold Hill" near the head of Wilson Creek and other streams running from the dome. Letters recently received at Valdez corroborate the report of Cliff Johnson who recently came direct from White River camp. With this comes a report from Nelchina that 70c. to \$1 and more has been found in hoies sunk on or near Caribou Creek. Lumber for sluicing is a problem now confronting some of those who plan work in Chisana. Recent arrivals report that men are whipsawing lumber. Whipsawed lumber brings 18 to 20c. per ft., or \$180 to \$200 per M., it is said. This is not considered excessive, considering cost of material in camp under present conditions. Heavy rains in summer, it is feared, may cause floods in cañons, that possibly will take out sluice boxes and fill workings with tailings. Most places in Bonanza cañon are narrow, wide enough for only one or two sluice boxes to be set up parallel and leave room for men. It was early in May when James party found gold on Bonanza last year, and all snow was not off ground. Sluicing is expected to begin in June this year.

**MOTHER LODGE COPPER MINES** (Kennecott)—A recent shipment to Tacoma weighed 198 tons, contained 15 oz. silver and 60% copper; settlement was at rate of \$147 per ton. Other shipments are to follow. Property is near Bonanza mine and is equipped with 6000-ft. aerial tram from Marvellous tunnel to "lower camp." This season \$150,000 will be spent in development work. Property is generally considered a promising prospect.

**ALASKA JUNEAU** (Juneau)—Drill crew has finished raise from Gold Creek tunnel to Silver Bow basin; it broke through a few hundred feet from old Alaska Juneau compressor house. After putting in a few sets of timbers raise will be ready for skips and hoist. First working level that will furnish ore for mill has been started between 600- and 100-ft. levels, the distances being counted from bottom of raise up.

## ARIZONA

### Cochise County

**OLD SLAG DUMPS AT BENSON** have been purchased by Joseph Larrieu and N. S. Finch.

### Gila County

**SUPERIOR & BOSTON** (Globe)—The 1200 level will not be unwatered until sufficient data have been secured on 1000 level relative to vein to insure against useless development work.

**IRON CAP** (Globe)—Winze on 650 level is 50 ft. deep and continues in high-grade ore. Winze to date has produced ore worth five times sinking cost. As stope on 650 has reached a height of 65 ft. and is still in high-grade ore, extent has been proved to exceed 115 ft. along dip of vein.

**INTERNATIONAL SMELTING & REFINING CO.** (Miami)—Work at smelter site is progressing rapidly, foundations for bedding bins now being poured. Next week will find those for waste-heat boiler plant in place and possibly foundations for three large reverberatories. Apr. 1 is the date set for arrival of first steel for smelter buildings.

**ARIZONA COMMERCIAL** (Globe)—A few weeks ago a round of drill holes passed into a fault zone, which at first was thought to be main vein. Later developments, however, showed this was a small separate fault, throw of which has probably resulted in slight displacement of main vein. Recent installation for raising water is proving satisfactory.

**INSPIRATION** (Miami)—All material for completing shop and warehouse building at concentrator is now on ground and structure is fast assuming a finished appearance. Of seven principal structures which will constitute company's plant, this will be first to be completed, but steel work on storage bin and crushing plant is all but finished and head-frames at main hoisting shafts are being rapidly erected. One hundred cars of steel for concentrator building are expected to arrive within next few weeks and with that portion of plant completed, which will probably require remainder of the month, all efforts will be directed toward erection of the buildings at the concentrator site. For this work 25 extra men, mostly riveters, are soon to be sent from the east. Trestle, which will soon span Geneva Gulch and enter concentrator above ore bins, will probably be the most impressive of any of the structures at the concentrator. It will be 1800 ft. in length and 120 ft. above foundations at the highest point. Approach will be single-tracked, but over bins will be double-tracked, as will also 200-ft. tail track on east side of concentrator building. A 200-k.v.a. transformer and a temporary switching station are now in place and when necessary connections are made with Roosevelt line all power now required at concentrator will be taken from this source. Stretching outfit has finished stringing eight cables to Inspiration camp and line is to be finished completely up to this point before proceeding to Superior. Rolling stock is now ample for handling all work that will be required, last

of the Ingoldsby 60-ton dump cars and second Porter locomotive having been received recently. McArthur Bros. have finished steam-shovel work at site of 5,000,000-gal. reservoir and only excavating left to be done will be finished in about a week by teams.

### Mohave County

**ARIZONA SOUTHWESTERN COPPER CO.** (Copperville)—Work in main shaft which is to be sunk 200 ft. deeper with drifts at 100-ft. intervals, is to be resumed.

**ECLIPSE** (Secret Pass)—Shaft is 200 ft. deep. A crosscut 12 ft. long was driven to vein, which is 6 ft. wide where cut. A strong flow of water has been encountered and until a pumping plant can be installed, work will be retarded.

**ARIZONA VENTURE** (Kingman)—Two carloads of machinery have been received. Shipment includes a large hoist, air compressor, drills, electric power plant and parts of a milling plant. Equipment is being hauled to property in Deluge Wash and is to be put into commission at once except mill, which will not be completed for several months.

### Pinal County

**RENFRO** (Troy)—An option on this group in Troy district and adjoining Troy-Arizona property has been given to Leo von Rosenberg, of New York, engineer in charge of Troy-Arizona work.

**BUCKHORN** (Ray)—First sinking in Gold Creek district was begun on this group, which adjoins Riggins group, where strike was made. Sherwood W. Aldridch, D. C. Jackling, S. W. Mudd and Ralph C. Nowland recently visited district. Work will be started at once on Riggins group, in which L. S. Cates is principal owner.

**GIBSON** (Ray)—Mine, 12 miles north of Ray, at head of Mineral Creek, has been sold to G. A. Whiteford and O. B. Kemp. Property has produced some extraordinarily rich copper-sulphides and has paid all development expenses from start. Gross value of ore shipped since 1906 exceeds \$1,500,000. A concentrator is to be built soon in which oil flotation will be used. At time of sale there were more than 20 leases on property. Under terms of sale ore on dumps on day of sale is property of purchasers.

**KELVIN-SULTANA** (Kelvin)—No. 2 raise has been holed through into old workings. Total distance raised was 162 ft. From bottom of No. 1 winze, corresponding to 400-ft. level, a crosscut was driven to No. 1 vein, which is 4 ft. wide at the place. A drift has been started east on vein. Three-compartment shaft is being sunk at a rate of 2 ft. per day, two shifts working. California Ore Testing Co. is making tests preliminary to designing concentrator. A new dormitory is being built. It is of steel and will have a double roof and large screened sleeping porch.

### Yavapai County

**CONGRESS** (Congress)—Negotiations are pending for sale of old tailings dumps. It is estimated that there are 800,000 tons of tailings that can be reworked profitably.

**LITTLE JESSE** (Chaparral)—Unwatering has been completed and development work is in progress on 200-ft. level. Property was taken over recently by Chaparral Mining Co.

**BIG PINE** (Hassayampa District)—Strike of high-grade silver ore was made recently in main tunnel. Property is under option and is being explored by prospective purchasers.

## CALIFORNIA

### Amador County

**PLYMOUTH CONSOLIDATED** (Plymouth)—Contract for construction of new mill provides for its completion in 120 days at a cost of \$27,568, less compensations for injuries during construction.

**ZEILA** (Jackson)—All underground and surface men have been laid off and mill closed down. Pumps are kept going. No decision has been reported from Breitung & Co. as to purchase negotiations.

**KENNEDY** (Jackson)—All four tailing wheels are in operation and working in good order. Flow of material and contour of basin are being studied for purpose of deciding upon essential points for restraining dams and possible conservation of water. A large body of water has been tapped on 3900-ft. level of mine. It is unusual to find water at great depth in Mother Lode region.

### Butte County

**CHEROKEE TOWNSHIP MAP** has been filed with county supervisors. Cherokee was one of the large hydraulic and drift gravel camps in early mining days of Butte County, and has occasionally produced diamonds.

**PROPOSED DREDGING OF HEWITT CLAIM** in town of Oroville has been abandoned in deference to objections of citizens who protested to municipal government. Proposition contemplated reclaiming land and turning it into a public park. Oroville grew from an unimportant to a flourishing town as a result of gold dredging and has never been damaged.

**MINERAL SLIDE** (Magalia)—This gravel mine has been a regular producer for last year and is reported to be one of the best in district.

**INDIAN SPRINGS** (Magalia)—Mine is to be reopened through old workings by Norman Torrison. It is said that rich gravel was disclosed at time of closing down, nine years ago.



**NUGGET GRAVEL MINING CO.** (San Francisco)—An electric pump and hoist have been installed at Smith drift mine, near Magalia. Development has been in progress for seven months. Mine is an extension of Indian Springs deposit.

#### Calaveras County

**UTICA** (Angels Camp)—A machine-drill man was killed Feb. 20, in Cross shaft, by fall of a loose rock he was drilling.

**BELL** (Murphys)—Mine has been bonded to Ashton Howard, of Angels Camp, who it is reported will reopen it. Good ore is reported to have been disclosed last summer.

**RED GOLD** (Murphys)—This mine is still idle, though it is reputed to be fairly developed. It is equipped with electric hoist and compressor. It is reported that reopening is contemplated.

**REINER MINING CO.** (Stockton)—John H. Owens has been appointed trustee for company, by F. A. Copestake, referee in bankruptcy proceedings. Property is at Altaville, near Angels Camp.

**BEATRICE** (Murphys)—Retimbering is finished. Installation of an electric hoist and compressor is contemplated. A 250-ft. winze will be sunk from 100-ft. level. Electric current will be taken from Utica power plant near Murphys.

#### Eldorado County

**GAMELO** (Eldorado)—A five-stamp mill was recently built at this mine in Nashville district. A good grade of ore is being milled from a 4-ft. vein.

**GRIFFITH** (Placerville)—It is reported that mine will be sold at public auction. Property embraces 150 acres and was developed by a 750-ft. vertical shaft 15 years ago.

**GEORGIA SLIDE** (Georgetown)—It is reported that mine is to be reopened and a new mill built. This mine was equipped with a Beer mill, about two years ago, but has not been operated recently.

**SHAW** (Eldorado)—H. de C. Richards, of San Francisco, is developing mine. Installation of three 10-ft. Lane mills is contemplated. Vein matter is said to be of great width and can be mined by open cut.

#### Fresno County

**PACIFIC** (Hollister)—Five flasks of quicksilver were shipped by way of Hollister, in February. Furnace will be started again in middle of March. A new short road is to be built, reducing distance from mine to railroad at Hollister. Work during past winter has been confined chiefly to development of ore for extraction when roads are in condition for hauling in supplies and shipments of quicksilver.

#### Imperial County

**PUMICE DEPOSITS** on an island in Salton Sea, owned by Robert Laughlin, of Los Angeles, and W. S. Williams, of Brawley, will be developed by a corporation to be organized for purpose. Island is one mile long and three-quarters of a mile wide, and is said to be chiefly, if not wholly, composed of pumice, which has been prospected to a depth of 30 ft.

#### Kern County

**CONSOLIDATED** (Randsburg)—Eighteen days' run of mill cleaned up 297 oz. of bullion, valued at \$4500. Ore averaged above \$30 per ton. New pumping plant is nearing completion. There are two triple electric pumps each of 25 gal. per min. capacity.

**YELLOW ASTER** (Randsburg)—Fifty stamps of 100-stamp mill have been connected to electric motor. Motor for other 50 stamps will be ready soon. Machine shop, rock crusher, air compressor and tramway are equipped by electric power. Entire plant will be electrically driven. Usual 5% dividend was declared on Jan. 28.

#### Modoc County

**BIG FOUR** (Highgrade)—Dispute over ownership resulting from alleged jumping of claims is to be tried in superior court.

#### Nevada County

**BRUNSWICK** (Grass Valley)—Deepening of 1250-ft. shaft is progressing; it is expected to intersect main vein.

**GOLDEN CENTER** (Grass Valley)—High-grade ore is reported to have been disclosed 300 ft. from shaft at 400-ft. depth. Exploitation drifts are being driven at other places.

**ROSE HILL** (Grass Valley)—Mine, within ¼ mile of Grass Valley, has been reopened after being idle about 50 years and a good vein of quartz disclosed. When caved tunnel was cleaned out, tools, cars and timbers were found. Old workings extend under town. A 110-ft. raise will be driven from a station near vein to top of bluff and a new shaft is contemplated. Old tunnels will be used for drainage only. J. J. Morris and S. J. Johnson, Sr., are developing under bond.

#### Placer County

**DREDGING GROUND IN GOLD HILL** mining district, on Auburn ravine, is reported to have been negotiated for by Lawrence Gardella, a dredge operator at Oroville. There are 400 acres in the tract. It was owned by Gold Hill Farms Co. and others.

**POVERTY BAR DREDGE** has been put in commission at Fitcher Ranch by Eldorado & Placer Counties Gold Mining & Power Co. Property consists of a number of bars situated north of holdings of Guggenheims who are operating Pacific dredge at Mammoth Bar.

**DAIRY FARM** (Sheridan)—This copper property, situated in Bear River district, east of Sheridan and 12 miles north-west of Auburn is being developed by Guggenheim interests. M. A. Newman, manager, has recently applied for a franchise to build a railroad to connect mine with Southern Pacific at Sheridan. Mine was a large producer in early days.

#### Shasta County

**WEST END** (Whiskeytown)—New 10-stamp Straub mill recently installed has been put in commission by Mt. Bally Mining Co. Ore has heretofore been treated at Gambrinus mill on Whiskey Creek.

## COLORADO

### Clear Creek County

**ACTIVITY IN CLEAR CREEK COUNTY** is greater for this time of year than for years past. Each camp is reporting improving conditions.

**ROCKFORD** (Idaho Springs)—This property, on Donaldson Mountain, is just beginning to ship again.

**SEATON & FOXHALL** (Idaho Springs)—These mines on Seaton Mountain, not far from town, have been idle for years owing to excessive quantity of sphalerite encountered in veins at a few hundred feet depth. Seaton vein is developed now by Newhouse tunnel. There is talk of consolidating two groups and erecting a zinc mill at mouth of tunnel.

**EAST LAKE**—This property is being developed by Joseph Klein & Co., lessees, who are operating through Big Five Tunnel. Profitable ore has been opened near intersection of Lake and Bellman veins where vein is 4 ft. wide. Last 40 ft. of drift on Lake vein has opened a streak of smelting ore assaying from \$15 to \$25 per ton. This streak is accompanied by milling ore assaying \$7 per ton.

**TRAIL CREEK MINING CO.** (Idaho Springs)—This company has granted an option on its mining property, known as New Era group and mill, near Freeland, Colo., to Calumet-Corbin Mining Co. Property is now being operated by latter company. Engineers who have recently examined property report that present ore reserves represent a net profit of \$250,000. Present operations are being financed by C. A. O'Leary & Co., of Minneapolis, Minn. H. G. Mills is president of Trail Creek Mining Co.

### Dolores County

**RICO-WELLINGTON** (Rico)—Property is represented to be in fine condition for producing low-grade copper. Efforts at securing more favorable freight and smelting rates have caused closing down until such time as these conditions are secured.

### Gilpin County

**I. X. L.** (Central City)—Reseigh & Co., lessees, are retimbering shaft of this mine that was last worked about 25 years ago. Mine is on Winnebago Hill, and formerly produced rich gold ore.

**PITTSBURGH** (Central City)—This mine is doing greatest amount of work on "company account" in county and has been operating continuously for nearly 20 years. Shipments go out regularly and ore is high grade.

**WAR DANCE** (Russell Gulch)—A hoist, a pump and a compressor, electrically driven, have been installed. The 500-ft. shaft is being sunk two more lifts of 100 ft. each and levels will be started along veins, in search for more rich ore such as was mined six years ago.

### Gunnison County

**STAR & INDEPENDENCE** (Crested Butte)—Both mines are sending down ore to this shipping point, by wagons, from Italian Mountain district.

### Lake County

**ELVA ELMA** (Leadville)—A vein formerly disclosed as dipping across a shaft has been again opened by Buchanan & Co., lessees, in a winze from one of the levels.

**LALLA ROOKH & FOREST CITY** (Leadville)—These mines, in Big Evans gulch and next New Monarch mine, are being equipped with electrically-driven machinery to operate as a single property.

**STAR OF THE WEST** (Leadville)—Lessees are working a small but rich vein, and have saved for shipment, when roads will permit, about 3000 lb. that is expected to assay about 40% lead and 2000 oz. silver.

**VIRGINIUS** (Leadville)—A new incorporation, the Consolidation Virginius Mining Co.—otherwise S. J. Sullivan and W. E. Bowden, will exploit this Sugar Loaf Mountain mine through Puzzler tunnel, last few hundred feet of which is along vein.

### Ouray County

**WANAKAH** (Ouray)—Brown Mountain smelting plant has been leased by Wanakah Mining Co. which will not only treat its own ore but will purchase custom ores.

### Park County

**MT. BROSS** (Alma)—Mill is nearly ready for regular service and works well.

### San Juan County

**HAMLET** (Howardsville)—Large ore bins have been built and new stopes have been opened. Mill will be run to capacity before long.

**HERCULES** (Silverton)—To satisfy a judgment, this property was sold at auction to Edward P. Ricker, Charles S. Smith and R. E. Paine. It is believed new owners will resume operations that were stopped by internal dissensions, some years ago.

### Teller County

**AJAX** (Victor)—Suit of Merrill Metallurgical Co. against Colburn-Ajax mill for infringement on zinc precipitation has been settled out of court, and mill has been licensed to operate under Merrill patents.

**ELKTON** (Elkton)—At a meeting of directors, James F. Burns, of Colorado Springs, was appointed to confer with other mine operators of southeast part of district in regard to an extension of Roosevelt drainage tunnel eastward.

**PORTLAND** (Victor)—A strong vein has been cut on lowest level, 1750 ft. deep, thus proving continuity of oreshoot to this depth. Lessees on 200-ft. level of old No. 1 shaft have been maintaining regular shipments. Among these leases may be mentioned that of Potvin & Co., on old Black Diamond vein, from which 5-oz. ore has been shipped.

## IDAHO

## Coeur d'Alene District

**NATIONAL COPPER** (Mullan)—With rapid development of company's mine to south of Missoula Copper Mining Co.'s property, and purchase of Missoula ground by Snowstorm company, Mullan copper belt has assumed unexpected possibilities. Developments in National have practically proved that there are at least three separate copper veins in belt, National having south vein, Missoula north and Independence, Copper King, Lucky Calumet and Snowshoe center vein.

**BUNKER HILL & SULLIVAN** (Kellogg)—A moving-picture film of operations at this mine will be made as the electrician has arranged an 8000-cp. arc light, to solve problem of illumination underground. Drilling and breaking ore will be shown and every step and process will be followed until ore is loaded on train for shipment to smelter. In addition to being shown in moving-picture theaters throughout country, film is to be placed at disposal of mining-engineering departments of colleges.

**SNOWSTORM** (Mullan)—Company now has control of practically 800,000 shares of Missoula Copper Mining Co. stock as a result of deals made in Spokane last week. Receipts being issued to stockholders of Missoula call for 60¢ per share. Snowstorm men have already entered into negotiations with Snowshoe and Lucky Calumet companies for surface rights for an electric tram line from lower workings of Missoula to No. 2 Snowstorm and for tunnel rights through Snowshoe and Lucky Calumet from No. 4 Snowstorm tunnel. Company proposes to run an electric line around mountain from No. 3 Missoula tunnel to No. 2 Snowstorm, where ore will be dropped through a raise to No. 3 level Snowstorm and thence conveyed by tram to mill at Larson. It is intention to begin work on this tram as soon as snow permits, and it is expected Missoula ore will be delivered to Snowstorm mill not later than June 1. No. 2 Snowstorm is 451 ft. higher than No. 3 Missoula. Plans are being made for extension of No. 4 Snowstorm tunnel through Snowshoe, Lucky Calumet and Independence properties to Missoula ground. Elevation of No. 4 Snowstorm is 3990 ft. and that of No. 2 Snowshoe 4491 ft.; therefore new tunnel will open Snowshoe orebodies at an additional depth of 501 ft. Some additional depth will be gained on Calumet ground. No. 3 Missoula tunnel is at an elevation of 4968 ft., which will give an additional depth in new tunnel of 1578 ft. Distance through ground from No. 4 Snowstorm to Missoula is about 8000 ft. Properties have exceptionally good copper showings both on surface and in lowest developments and are all on same vein system. Snowshoe has a large body of 2½ to 3% copper ore in its lower tunnel. Calumet has a good body of low-grade ore in upper workings, but has not found ore in lower tunnel at present; Independence property has a copper vein 30 ft. wide on surface, which assays 3 to 5% copper, and Copper King has developed a copper vein in its lower tunnel which assays from 4 to 5% copper, with some silver and lead.

## MICHIGAN

## Iron

**CARPENTER** (Crystal Falls)—This property is being opened up rapidly and main orebody should be reached within a few days. Shaft is 500 ft. from ore and drifting has already been carried on for 400 ft. Some ore has been encountered but it is not of good grade. As soon as clean ore is reached work of erecting a headframe will be started and mine will be ready to ship.

**CLEVELAND-CLIFFS IRON CO.** (Crystal Falls)—Company is still drilling on several parcels of land and it is known that one orebody of fair size has been found. Just when this will be opened has not been decided. Nothing has been announced as to what has been found on other properties being drilled. Company also has drills at work at Negaunee, Ishpeming and on the Cuyuna.

**JUDSON** (Alpha)—Shaft will be sunk another 100 ft. and orebody opened at a greater depth and drained. Development work is still being continued and plan that will be adopted for getting out ore will not be decided upon until work is finished. Several thousand tons of ore have been brought to surface from development drifts and will be shipped this season. Little water has been encountered thus far, although it was believed that a large flow would be found.

## MINNESOTA

## Duluth

**NAVIGATION ON UPPER LAKES** will undoubtedly open sooner this year than last, although opening will not be so anxiously awaited as heretofore. The winter has been a light one, and large stocks of coal still remain on Duluth and Superior docks. Likewise, Eastern furnaces have large stockpiles of ore remaining, and, except in special instances, little iron ore will need to be rushed forward. Last year Duluth Harbor opened Apr. 16. Earliest opening on record was in 1911, being Mar. 1, and latest in 1882, when it remained closed by ice until May 15. Ice is still 25 in. thick in harbor, and field extends from two to four miles from shore. At Soo ice is but 18 in. thick. It is, of course, unnecessary for ice to melt, except along shore line, when wind carries field into lake. Only 33 freighters wintered in Duluth last winter, a much smaller number than usual. Winter logging operations have been light in Minnesota woods, because of lack of snow until latter part of season. "Lumber-jacks" not having usual fat roll this spring, will be less independent than heretofore, which will assist labor situation on Minnesota iron ranges. Scores of woodsmen are reaching Duluth daily, on their way to various ranges for work in open pits and underground operations during busy season.

## Cuyuna Range

**IN RAILROAD WORK ON CUYUNA** a contract has been awarded by Cuyuna Northern Ry., Northern Pacific subsidiary, to McCullough & Cheney for an extension of line through Iron Mountain townsite to Duluth-Brainerd mine. Northern Pacific is about to begin construction on a 1½-mile spur from its main line to Canadian-Cuyuna mine, which spur

will leave main line at Loerch. Cuyuna Northern line into Kennedy mine is about completed.

**DULUTH-BRAINERD** (Ironton)—Shaft now down 115 ft. and still in green slate.

**PENNINGTON** (Crosby)—Additional new boilers are being installed. Preliminary operations have begun.

**CUYUNA-MILLE LACS** (Ironton)—Work of installing 2500-gal. pump on 205 level continues. Pump gives ample capacity for regular and auxiliary service.

**ROWE** (Riverton)—Additional electrical equipment is being installed. New, variable high-speed motors have been installed, and electrical power is used for pumps, sand sucker and all hydraulic work.

## Mesabi Range

**JOSEPH MINELLI VS. OLIVER IRON MINING CO.**, case is being appealed to supreme court of state. Case is of considerable interest to mine operators in general. Plaintiff alleges depreciation in value of his property due to removal, by mining company, of a viaduct across Sellers open pit. This viaduct provided shortest route from Hibbing to Chisholm and to mining locations of Webb, Laura, Morris and Columbia, and a decision in favor of plaintiff will mean inauguration of hundreds of suits against mining company. Local court has already rendered a verdict against company. Case is in nature of a test as to right of operating companies to remove a traveled highway without providing some other manner of ingress and egress to adjoining property, even though right-of-way is owned, constructed and kept up by operating company. Mesabi electric line is contemplating an extension of its line westward to Grand Rapids and other towns in that vicinity, where there is considerable mining activity.

**PRINDLE** (Virginia)—This mine, north of Virginia and adjoining Alpena mine on west, will be stripped during coming season. Active preparations to this end are now being made. Property owned by Oliver Iron Mining Co.

## Vermilion Range

**CONSOLIDATED VERMILION & EXTENSION** (Tower)—At company's Mud Creek mine, a vein of apparently high-grade iron ore has been encountered on 400 level, 110 ft. from shaft, drift now being 10 ft. in such material. Same vein was encountered on 300 level, but was not of merchantable grade.

## MISSOURI-KANSAS-OKLAHOMA

## Joplin District

**WEEKS & BRIGGLE** (Carl Junction, Mo.)—Mine has been closed down temporarily.

**RAINS & CHILDRESS** (Galena, Kan.)—New equipment has been installed at mine.

**PRODUCER** (Joplin, Mo.)—Mine has been closed on account of water. Deposits considered insufficient to justify installation of pumping plant.

**BOSTON-AURORA CO.** (Thoms Station, Mo.)—Concentrator is being moved from Rex tract. Company has 10-acre lease. Ore formation is from depth of 162 to 182 ft.

**AMERICAN ZINC, LEAD & SMELTING CO.**—A strike was made last week at Midway, near Joplin. Cuttings from drill hole at 87-ft. level are said to run 20%.

**DODGE LAND** (Spurgeon, Mo.)—Lease has been taken by John Henderson & Co. and drill has been moved to tract. Sublease let to Spring City Lead & Zinc Co.

**POCAHONTAS MINING CO.**—Company has taken lease on 40 acres of St. Louis-Joplin Lead & Zinc Co.'s land at Chitwood. Much prospecting with good results has been done.

**J. A. ROGERS** (Hattonville, Okla.)—Operations are retarded by water. Pumps will be installed. One of richest lead strikes in Miami-Hattonville district was made here.

**LEE & BRIDGEPORT** (Spring City, Mo.)—Concentrator expected to be completed and placed in operation within a week. It is on J. W. Allen land and will be of 250-ton capacity.

**PING & CO.** (Galena, Kan.)—Old Grand Haven mine near Webb City, Mo., has been taken over by this company. Formerly good orebodies were worked, but operations were suspended.

**SCHOOL HOUSE MINING CO.** (Carterville, Mo.)—This company, recently incorporated, is erecting concentrator, work nearly completed. Rich sheet-ground ore is being worked.

**MAGGIE TAYLOR** (Galena, Kan.)—Robert Ping & Co. have purchased entire tract and will start extensive prospecting campaign. Is one of oldest tracts in Galena district and has produced much mineral.

**COATS & ORT** (Joplin, Mo.)—Company has sold its mine and 120-acre lease at Thoms Station to Ohio men for \$35,000. Vinegar Hill and Coats & Ort properties are on tract, known as Snapp land. Each operates a concentrator. High-grade ore is being produced.

**T. E. McCURE, GEORGE STRATTON, JAMES GALBREATH**, of Aurora, Mo., have purchased a concentrator and are moving it to Zinc, Ark. The zinc fields have not been developed thoroughly. Company has obtained leases on large tracts and will prospect extensively.

**OKLAHOMA TRIPOLI CO.** (Peoria, Okla.)—Failure of Eastern banking institution resulted in closing plant which was one of finest in country and only one in Oklahoma. Had just got under way when crash came, after investment of \$75,000 had been made. Two carloads of product in bins ready for shipment.

**ORONOGO CIRCLE** (Oronogo, Mo.)—This mine recently produced 415 tons of zinc concentrates and 30 tons of galena, total production being \$19,000 for one week. In last seven weeks, mine has produced 1558 tons of blende and 600 tons of galena, making grand total for seven weeks, \$93,878. Mine has been in operation 40 years, having yielded more than \$7,000,000 worth of ore. It is owned by J. B. Moos and Henry Russell Platt, of Chicago.



**MONTANA**

**Deer Lodge County**

**TRIUNE & ORO-FINO** (Georgetown)—Main shaft on Triune is to be extended 135 ft. under contract let by Van Dyke & Murdock, who have a lease and bond on property. In course of development work small kidneys of ore containing free gold have been encountered. On Oro-Fino, a fraction of which has been leased by Van Dyke & Murdock, a new shaft has been started which is 27 ft. deep.

**Fergus County**

**BARNES KING DEVELOPMENT CO.** (Kendall)—President C. W. Goodale and party have returned to Butte from Kendall, where annual meeting was held recently. Old board of directors was reelected. Old Santiago shaft has been connected up and all is in readiness to begin operations through it in place of old Barnes King shaft. This will result in a considerable saving in cost of underground haulage. Gross returns for month of January were \$45,000 and mining and milling expenses were \$20,000 at Kendall properties of company. After another payment of \$5000 for purchase of Piegan-Gloster group of mines at Marysville, Lewis & Clark County, Barnes King company will be free from obligations and have about \$20,000 in treasury. With release of money tied up in litigation, soon to be settled, another \$90,000 will be added to treasury. All work on Piegan-Gloster mines is being paid at present out of earnings of North Moccasin at Kendall.

**Madison County**

**LEHI GOLD MINING CO.** (Norris)—Operations on a large scale are planned for mines of this company, in Boulder Mountains, 12 miles southwest of Norris. At present copper-silver ore is treated in old mill of Blackhawk mine adjoining and concentrates are shipped to Anaconda and East Helena. A new compressor plant is being built and other improvements are planned which will materially increase output.

**Silver Bow County**

**ELLA** (Butte)—Equipment for this recently acquired property of Anaconda Copper Mining Co., consisting of head-frame, engine room, ore bin and all necessary machinery, is completed. Shaft has been retimbered to 300-ft. level without encountering water and three shifts of six men each are at work in developing property.

**BULLWHACKER** (Butte)—Operations at new leaching plant during February, although satisfactory in general, have revealed fact that solutions used in electrolytic process become muddy and thus interfere with precipitation of copper. To remedy this defect company is planning installation of a Kelley filter. Plant has been temporarily shut down until filter is installed.

**BUTTE & GREAT FALLS MINING CO.** (Butte)—Properties of this company, four miles north of Butte, are being rapidly developed. Prospecting of Genevieve vein is carried on at present from surface by churn drills. This vein which is from 50 to 60 ft. wide on surface has been developed on 200-ft. level by a crosscut which has so far been driven 30 ft. in vein without reaching hanging wall. Ore opened assays as high as 10% copper. Churn drills are expected to reach vein at a depth of 600 ft. from surface.

**BUTTE & LONDON COPPER DEVELOPMENT CO.** (Butte)—Installation of 425-hp. electric Nordberg hoist at mine in eastern extremity of district, has been completed, and preparations are under way for installation of a 2800-cu.ft. compressor and a 600-gal pump capable of lifting that amount of water from 1100-ft. level to surface. All necessary machinery installed and ordered will permit development work to 2500-ft. level. Company has entered a contract with Rainbow Development Co. by which latter is to carry on development work on 102 acres, known as Greendale placer claim, owned by Butte & London and conveyed to Greendale Exploration Co. Shaft on this property, which is 1300 ft. deep, is to be sunk to 1600-ft. level and crosscuts are to be driven from bottom to north and south boundaries of property for which work Rainbow company is to receive 51% of stock of Greendale company.

**NEVADA**

**Elko County**

**OIL REFINERY AT ELKO**, it is reported, will be built to treat oil shale found there. Plant will be built by R. M. Catlin and associates of New Jersey.

**Esmeralda County**

**GOLDFIELD-FLORENCE MINING CO.** (Goldfield)—Development work has met with satisfactory results. President A. D. Parker denies report that mine or part of it will be leased.

**GOLDEN GATE MINING CO.** (Goldfield)—Articles of incorporation have been filed; capitalization, \$500,000; par value, \$1. Company will operate Gast mine in Lone Mountain district. First work will be erection of new bunk and boarding houses.

**Lander County**

**NEW GOLD STRIKE IN COPPER CANYON DISTRICT**, it is reported, has been made 18 miles south of Battle Mountain.

**TOMBOY** (Battle Mountain)—Shaft has been sunk on this property in Copper Cañon to depth of 75 ft. and drifting has opened oreshoot assaying \$8. Tunnel is being driven to cut shoot at depth of 150-ft. It is stated that 25,000 tons of ore are developed, and that a 100-ton cyanide plant will be built this spring.

**Lyon County**

**MASON VALLEY MINES CO.** (Thompson)—Statement issued by Frank W. Holmes, vice-president, for quarter ended Dec. 31, 1913: Mason Valley ore mined, 27,825 tons; smelting plant treated, 50,197 tons; matte produced, 3610 tons yielding 3,694,227 lb. refined copper. Gross operating profit, \$53,562; depreciation and deferred payments, \$24,233; bond interest, \$14,040; net profit, \$15,289.

**Nye County**

**GOLD STRIKE AT BLACKTHORN** is reported. This new camp is 25 miles east of Goldfield and three miles west of Antelope Springs, nearest water supply.

**TONOPAH VICTOR** (Tonopah)—John G. Kirchen, denies report that merger has been effected with Tonopah Merger Co.

**MONTANA TONOPAH** (Tonopah)—Extension of McDonald vein has been struck on 698-ft. level. Shoot is of milling grade ore and 4 ft. wide.

**Storey County**

**SIERRA NEVADA** (Virginia City)—Work has been resumed on 2500-ft. level, and a winze will be sunk in segment of vein in which a rich streak of ore was developed above that level.

**COMSTOCK PUMPING ASSOCIATION** (Virginia City)—Two air-driven pumps are to be installed on 2700-ft. station of Consolidated Virginia winze, after which this level will be prepared for exploration for first time since 1885.

**OPHIR-MEXICAN WINZE** (Virginia City)—The 2500 station is being repaired, preparatory to installation of electric hoist, after which winze will be used as operating base for 2600 level, to be opened for first time in history of Comstock.

**CONSOLIDATED VIRGINIA** (Virginia City)—A northeast drift, started east of 2500 shaft station on east vein in this mine, is showing good prospects, quartz in place along foot-wall giving low assays. This drift will intercept gold ore stope opened on 2400-ft. level.

**YELLOW JACKET** (Virginia City)—Mill has resumed operations after a two-months' shut down, due to storms interfering with surface tram. Crown Point is shipping ore to this mill from 1300, and Belcher will start ore recovery from 1500 level in near future.

**OPHIR** (Virginia City)—On 2350 intermediate level, a south drift has been extended 30 ft. on a shoot of ore in east vein, average car samples to date show close to \$50 per ton. Vein is split, with richest ore on hanging-wall side. Latest blasting shows 4 ft. of ore on foot-wall side assaying \$45 per ton; that on hanging wall assays \$56. A crosscut is being driven on 2400-ft. level to pick up downward extension of ore.

**White Pine County**

**ESMERALDA** (Ely)—A two-stamp mill will be installed at this property in Irwin cañon.

**ALVIN** (Ely)—Good-grade ore has been developed in this mine in Granite district. Bullion has been shipped from mill run at Campbell mill.

**LUCKY DEPOSIT** (Aurum)—Good-grade copper-carbonate ore has been cut by tunnel, and sulphide ore has been struck in winze. Outcrop is 22 ft. wide, and samples have been taken which assayed 4% copper.

**MIZPAH CONSOLIDATED COPPER & GOLD MINING CO.** (Ely)—Tunnel is now in 1370 ft. and good indications for ore are showing in breast. Prospecting on Benny Straught vein has opened shoot of shipping grade ore.

**CONSOLIDATED COPPER MINES CO.** (Ely)—Minnesota shaft is being sunk 150 ft. deeper. Jackhamers are used and sinking pump has been installed. Drifts will be driven to further develop good-grade oreshoot opened in Butcher Boy shaft.

**NEW MEXICO**

**Doña Ana County**

**ORGAN MOUNTAINS** (Las Cruces)—A lease has been given on Memphis mine and upper Bennett-Stephenson property. Company is developing lower workings.

**Grant County**

**HANOVER COPPER CO.** (Hanover)—J. S. Dickie was awarded several claims in litigation by court in Silver City, Mar. 6.

**BIG BURRO COPPER CO.** (Tyrone)—Company has effected consolidation of property in Burro Mountain district not owned by large mining corporations. Incorporation papers have been recently filed at Santa Fé. Capitalization, \$1,000,000. King Wade, of Tyrone, is manager. Extensive development work is outlined.

**Lincoln County**

**HOMESTAKE** (White Oaks)—Full force is being employed at 20-stamp mill day and night shifts. Cyanide plant is also in operation.

**Otero County**

**NANNIE BAIRD** (Jarilla)—Strike is reported; over 200 sacks of 2-oz. gold ore are ready for shipment.

**IRON KING** (Jarilla)—About 1000 tons of iron ore are being shipped daily to Pueblo, Colo.

**Quay County**

**NARAVISA**—Company has been organized to drill for oil in northern parts of county.

**Socorro County**

**EBERLE** (Mogollon)—Mine is being surveyed and sampled by Oaks company preparatory to starting development. Mine is already partially opened up.

**FIFTH MINING NEWS**  
**LINCOLN MINING & DEVELOPMENT CO.** (Mogollon)—After completing new machinery installation shaft has been unwatered and sinking resumed below mill adit or fifth level.  
**SOCORRO MINING & MILLING CO.** (Mogollon)—The 900-ft. level has penetrated an oreshoot 8 ft. wide assaying \$50. Company recently retired its \$200,000 issue of preferred stock from earnings.

**Taos County**

**COPPER HILL**—Ten tons of vanadium ore were shipped by Frank Gallup and Joseph Prior from Embudo to refinery.

**OREGON****Baker County**

**IMPERIAL** (Cracker Creek District—via Sumpter)—Scotfield & Simmons, lessees of this mine between Cable Cove and Cracker districts have just shipped three carloads of crude ore to Salt Lake smelters. Another shipment of two carloads will be made in a few days. Ore worth \$200 per ton was opened in one stope. None of this high-grade ore has as yet been shipped, though it is stated that consignment will be sent out soon. Snow road to mine is now in good condition and regular trips are being made to Sumpter with sacked ore.

**Coos County**

**LANE MINING CO.** (Marshfield)—Company is installing machinery and making preparations for gold mining on beach near Whiskey Run Creek, a stream which has an outlet into ocean between Coos Bay and Bandon. Intention is to work black sands for gold and platinum. Whiskey Run is a district that in early days was extensively mined. At one time town of Randolph was established there and for a few years was biggest town in Coos County. One winter heavy surf carried gold away and place was deserted but has been mined in a crude way for a few years past and now beach is said to be good.

**SOUTH DAKOTA****Lawrence County**

**TROJAN** (Trojan)—During February mill averaged 212 tons daily, and fully matured plans for largely increasing capacity will be carried out with coming of suitable weather for building operations.

**ORO HONDO** (Lead)—Work of dewatering 1050-ft. shaft, in which water stood within 50 ft. of collar, has commenced, utilizing 2 skips of 600-gal capacity each. It is anticipated water will be all removed by Mar. 20. Shaft and workings make little water. Timbers below water level have been found to be in excellent condition, and above water level few repairs were necessary. Large boarding house at Pluma, 1 mile from property, has been rented for crew. Pending construction of railroad spur, coal and supplies will be hauled from Pluma.

**HEIDELBERG** (Two Bit)—Since development started last autumn by syndicate organized by Deadwood Business club, much preparatory work, including road building and construction of bunk house, assay office, blacksmith shop, etc., has been completed, and in past month more active work has been done in mine. Principal workings are confined to development of an ore vertical 3 to 10 ft. wide, cutting cambrian sand- and lime-shales. Drifting and raising along this vertical is under way. So far it has been followed 160 ft. No development has been done above what appears to be an intruded sheet of porphyry, nor has any sinking been done. Working tunnel has been enlarged and re-timbered, and in course of this work much ore has been extracted, of which 35 tons, in two lots, has been sent to Golden Reward cyanide mill, at Deadwood, and rest piled on dump. Ore shipped assayed \$16 and \$20 for two lots. Dump ore will assay \$3 to \$6. Ore is excellent for cyaniding. Crosscut is being driven in new territory in search for other similar verticals. Further plans contemplate diamond drilling, preliminary to sinking to basal cambrian quartzite.

**Pennington County**

**FIRST NATIONAL** (Hill City)—Drifting on ore at 165 ft. depth is in progress. Ore being removed is piled on dump, pending some alterations to mill.

**DAKOTA CONTINENTAL COPPER** (Hill City)—Sinking is now under way, with intention of continuing to 1000-ft. level. On Mar. 1 shaft was 830 ft. deep having been sunk 17 ft. in 17 days, with "Jackhammer" drills and crew of men not experienced with these machines. Better progress is anticipated in future.

**UTAH****Juab County**

**TINTIC SHIPMENTS FOR FEBRUARY** amounted to 620 cars or approximately 31,000 tons of ore from 26 mines, as compared to 684 cars in January. Shipments for week ended Feb. 27 amounted to 165 cars.

**OPOHONGO** (Mammoth)—A strike of gold ore by lessees is reported. Three cars were shipped in February.

**EMERALD** (Mammoth)—Developments on 700-ft. level north are favorable, drift following a strong fissure mineralized with iron and manganese.

**DRAGON CONSOLIDATED** (Silver City)—Fourteen feet of quartz has been cut on 1000 level. It carries milling ore in places. The report for 1913 has been issued.

**BECK TUNNEL** (Silver City)—Twelve blocks of ground are being worked by lessees. Since the first of the year, three cars of silver-lead ore have been shipped.

**KNIGHT MILL** (Silver City)—Roasting arrangements have been changed, and no further trouble is anticipated. A trial run on Colorado and Black Jack ores will be made soon.

**IRON BLOSSOM** (Silver City)—No. 1 and No. 3 workings are producing about same tonnage. Silver-lead ore is being mined from new east vein in northern part of ground. About 200 tons of copper ore monthly is being shipped. Development is being done on 1900 toward south end of property.

**EAGLE & BLUE BELL** (Eureka)—A dividend of 5c. per share, aggregating \$45,000 has been declared, payable Apr. 1. Four dividends were paid in 1913, last having been paid in November. Including present dividend, total will be \$225,000. In January and February 5700 tons of ore were shipped. Connections between drift on 1550 and winze from 1350 will be completed in April. A new orebody has been cut in north drift on 1550 level, 250 ft. from shaft. This carries silver, lead and gold, and has been opened 15 ft. Extent has not been determined. This orebody was unexpected, and is not known to be continuation of any other ore. Present production is between one and two cars of ore daily.

**Salt Lake County**

**RAILROAD FROM SANDY TO WASATCH** has reduced transportation charges on Alta ore \$2.05 per ton on ore worth \$15 or less, and \$1.75 on ore worth more than \$15, net smelter returns. This will help Alta operators and allow mining of lower grade ore than has heretofore been possible.

**UTAH CONSOLIDATED** (Bingham)—Both copper and lead ores are being mined, and sent over tramway to International. Dividends paid recently have been earned largely from lead ore production.

**MONTANA-BINGHAM** (Bingham)—Tunnel is in 2700-ft. face being in quartzite mineralized with iron. Work is in Bingham Amalgamated territory, and is approaching Copper Glance and Congor veins. If continued far enough several veins in Fortuna ground will be cut.

**WASATCH MINES** (Alta)—Recent strike made by lessees above main tunnel in Columbus Consolidated section is producing 20 tons of ore daily. Ore is lead carbonate, and has been opened for 30 ft. on strike, and is 4 ft. thick. It is being followed on dip of beds toward surface 300 ft. distant. Strike is near large orebody mined a few years ago, though latter was largely below tunnel level. Ore extends from lessees ground into company ground, and will be worked on company account.

**Tooele County**

**WILSON CONSOLIDATED** (Frank L. Wilson, Arcade Bldg., Salt Lake City)—This bismuth mine is 2½ or 3 miles south of Gold Hill in Deep Creek section, or about 48 miles south of railroad at Wendover. Bismuth ore occurs in limestone in a vein or bedded deposit up to 11 ft. thick, near a porphyry dike. Ore is said to consist of bismuth sulphide and a greenish oxidized mineral, latter sometimes showing finely divided free gold. It is said to carry from 5 to 30% bismuth, and occasionally 60%.

**WISCONSIN****Platteville District**

**ROADS ARE IN SUCH BAD CONDITION** that shipments are few and much ore is being stored in mill bins.

**SANS SOUCI** (Shullsburg)—This is a new property that has begun to ship ore.

**CRAWHILL**—Mine is largest shipper in district and plans are being made for enlarging mill to 500 tons daily capacity.

**VINEGAR HILL** (Galena)—Mine, which has been a large steady shipper since 1906, is being robbed of its pillars.

**ROOSEVELT**—This mine has been acquired by Chicago men and is again shipping from a large low-grade orebody.

**EWING**—This mine, formerly the Etna, has been equipped with new machinery and is again shipping from upper runs.

**ENTERPRISE** (Platteville)—This old mine, which paid \$180,000 in dividends, is being reopened and ore is being opened in upper runs on town lot leases that were recently taken over.

**FRONTIER** (Benton)—New ore bodies in lower ground are being opened that promise an important extension of life. Old stopes are over 70 ft. high from which \$175,000 in dividends has been paid, on an investment of about \$40,000 since 1907. Bull Moose mine, owned by same men, has begun shipping, after experiencing serious trouble from excessive water that was finally controlled by Texas pumps.

**Sawyer County**

**OLIVER IRON MINING CO.** (Coudera) —Company has had two diamond drills drilling for iron ore during last six months in vicinity of Birchwood, Edgewater and Stone Lake, where company has thousands of acres of land optioned. Results of drilling have not been given out. District is many miles from any known iron-ore deposits, and not contiguous to any iron formation generally known.

**CANADA****British Columbia**

**ON GRAHAM ISLAND** a new syndicate, organized in Vancouver, will prove coal measures with two diamond drills.

**PORTLAND CANAL TUNNELS** (Stewart)—In one of the drifts being driven from low level adit 2 ft. of ore has been struck.

**Cobalt**

**ORE SHIPMENTS FROM COBALT** for February were: Alladin (Silver Queen), 27.50 tons; Beaver, \$2.51; City of Cobalt, 38.88; Cobalt Lake, 125.06; Cobalt Townsite, 161.28; Coniagas, 70.07; Crown Reserve, 22.99, by Dominion Reduction Co., 122.76, 145.75; Hudson Bay, 129.67; Kerr Lake 30.62, by Dominion Reduction Co., 92.61, 123.23; La Rose, 42.26; Mc-Kinley-Darragh, 281.12; Peterson Lake (Seneca Superior), 52.34; Nipissing, 135.21; Penn Canadian, 25.98; O'Brien, 63.28; Timiskaming, 80.35; Trethewey, 43.79; Total, 1628.28 tons.

**APEX** (Porcupine)—This property is under option to a private syndicate.

**BARTLETT** (Cobalt)—Miller Lake O'Brien company, of which M. J. O'Brien is owner, has taken an option on this property.

**LA ROSE** (Cobalt)—Company has taken an option on Jupiter mine at Porcupine and has taken obligations to spend a certain sum of money in development.

**COBALT LAKE** (Cobalt)—Mill is to be enlarged to treat 175 tons a day. This will permit treating some lower grade ores, of which there is a considerable tonnage in the mine.

**TIMISKAMING** (Cobalt)—At recent annual meeting, none of old directors was returned and practically all new directors are also directors in Beaver property adjoining. It has been definitely stated, however, that there is no amalgamation to be considered between these properties.

**HOLLINGER** (Timmins)—Steady decrease of mill heads shown by four weekly reports is due to fact that large bodies of medium grade ore are being opened up and desire of directors to conserve high-grade reserves. When additional 20 stamps are in operation, company should make same margin of profit on a lower grade ore.



# The Market Report

## METAL MARKETS

NEW YORK—Mar. 18

The metal markets remain generally quiet, with no special demand and with some tendency to declining prices, but no important changes.

### Copper, Tin, Lead and Zinc

**Copper**—The market during the last week has been active, interesting and complicated. The pressure to sell, noted in our last report, continued and copper was offered down in the efforts to sell from almost all quarters. The policy with many producers and agencies seemed to be to sell simply for what they could get. In these circumstances some unusual allowances on the delivered price, materially reducing the net price realized, were assumed by sellers, particularly on export business, the terms on which such business was done being in general less than on domestic business. By Mar. 13 copper was sold at 14¼c., delivered, with charges, etc., and on subsequent days there were sales as low as 14.05@14.10c., delivered in Europe. The market was throughout a good deal mixed, the same sellers consummating transactions with different people at different prices at the same time, and prices changing during the same day. The concessions made by producers developed a rather large business, both for domestic and foreign account, the latter predominating, and by Mar. 17 producers had sold so liberally that one after another raised its price, with buyers following the market upward. At the end of that day sales were made at 14¼c., delivered, usual terms, and some sellers were asking 14¾c. Mar. 18 opened with sales at 14¼c., delivered, usual terms, but during the morning 14¾c. was realized and that price prevailed at the close, with some sellers having raised their asking price to 14½c. Stocks in the hands of manufacturers, both here and abroad, are believed to be low and orders are said to be coming in to them at a somewhat better rate.

The average of electrolytic quotations for the week is 14 cents.

Some small sales of Lake copper were made from day to day at 14½@14¾c. Nothing definite seems to be known respecting the attitude of the principal producer.

The standard market hung around £63 to £63 10s. for spot and £63 10s. to £64 for three months, until Tuesday, Mar. 17, when spot advanced to £63 16s. 3d. and three months to £64 5s. The market closes strong at £64 8s. 9d. for spot and £64 18s. 9d. for three months.

Base price of copper sheets on Mar. 13 was lowered ¼c. and is now 19¾c. per lb. for hot rolled and 20¾c. for cold rolled. The usual extras are charged and higher prices for small quantities. Copper wire is 15¼@15¾c., carload lots at mill.

Exports of copper from New York for the week were 10,654 long tons. Our special correspondent reports exports from Baltimore for the week at 6421 tons.

**Visible Stocks of Copper in Europe** on Mar. 16 are reported as follows: Great Britain, 10,490; France, 1810; Rotterdam, 3150; Hamburg, 3890; Bremen, 1110; other European ports, 750; total, 21,200 long tons, or 47,488,000 lb. This is an increase of 50 tons over Mar. 2. In addition to the stocks above 2500 tons are reported afloat from Chile and 3800 from Australia, making a total of 27,500 tons.

**Tin**—The markets, both here and in London, were very dull, but displayed a firm undertone. Consumers evinced some interest in futures and would have bought liberally had sellers been ready to meet their views. An improvement in the statistics is expected and sellers are not anxious to make concessions. The market closes steady at about 38¾c. for March tin here, and £174 7s. 6d. for spot and £176 10s. for three months in London.

**Lead**—The market is quiet with a fair business doing at about last prices, 4c., New York and 3.87½@3.90c., St. Louis.

The London market is unchanged, Spanish lead being quoted £19 12s. 6d. and English lead 15s. higher.

Exports from Baltimore for the week included 60,416 lb. lead to Liverpool.

**Spelter**—The market for this metal has been rather curious. During the early days some considerable sales were made on the basis of 5.10c., St. Louis. On Mar. 14, while there were still sellers at that price, a round lot was negotiated at 5.12½c. On the following days spelter was freely offered at 5.10c. without finding buyers, the market being nominal with indications that business could be done around 5.07½c.

The London market is unchanged, good ordinaries being quoted £21 10s.; specials 10s. higher. The European syndicate at its meeting on Mar. 17 made no change in its price.

Base price of zinc sheets on Mar. 11 was decreased ¼c. and is now \$7 per 100 lb. f.o.b. Peru, Ill., less 8% discount, with the usual extras.

### DAILY PRICES OF METALS

#### NEW YORK

Mar.	Sterling Exchange	Silver	Copper		Tin Cts. per lb.	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.		New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
12	4.8615	57½	@14¼	@13.95	37½	4.00	@3.87½	@5.22½	@5.07½
13	4.8615	58	@14¼	@13.90	37½	4.00	@3.87½	@5.22½	@5.07½
14	4.8625	58½	@14¼	@13.90	37½	4.00	@3.87½	@5.22½	@5.07½
16	4.8620	58½	@14¼	@13.95	38	4.00	@3.90	@5.25	@5.10
17	4.8630	58½	@14¼	@13.95	38½	4.00	@3.90	@5.25	@5.10
18	4.8645	58	@14¼	@14.15	38½	4.00	@3.90	@5.25	@5.10

The quotations herein given are our appraisal of the markets for copper, lead spelter and tin based on wholesale contracts; and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.15c. apart. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic; of casting copper 0.15 to 0.25c. below. The quotations for lead represent wholesale transactions in the open market for good ordinary brands; the specially refined corrodng lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb., are: St. Louis-New York, 15½c.; St. Louis-Chicago, 6c.; St. Louis-Pittsburgh, 12½c.; New York-Bremen or Rotterdam, 15c.; New York-Havre, 16@17½c.; New York-London, 16c.; New York-Hamburg, 18c.; New York-Trieste, 22c.

#### LONDON

Mar.	Silver	Copper				Tin		Lead		Zinc	
		£ per Ton	Cts. per lb.	3 Mos.	Best Sel'd	Spot	3 Mos.	£ per Ton	Cts. per lb.	£ per Ton	Cts. per lb.
12	26½	63 ⅞	13 76	63 ⅞	68½	172½	174½	20	4 35	21½	4 67
13	26½	63	13 69	63 ⅞	68½	172½	174½	19½	4 32	21½	4 71
14	26½	...	...	...	...	...	...	...	...	...	...
16	26½	63½	13 80	64	68½	173½	175½	19½	4 32	21½	4 67
17	26½	63½	13 86	64½	68½	173½	175½	20	4 35	21½	4 67
18	26½	64 ⅞	14 00	64½	69½	174½	176½	19½	4 26	21½	4 67

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. 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 = 0.21½c.

### Other Metals

**Aluminum**—The market has been dull, so far as sales are concerned and there seems to be a good deal of competition for what business is going. Prices are weaker, 18¼@18¾c. per lb. being quoted for No. 1 ingots, New York.

**Antimony**—Business remains quiet, with a fair jobbing demand. Cookson's is quoted at 7.20@7.35c. per lb., and Hallett's at 7@7.15c.; while 6@6.15c. is named for Chinese, Hungarian and other outside brands

**Quicksilver**—Business is fair and the market is steady. New York quotations remain unchanged at \$39 per flask of 75 lb. for large lots, and 54c. per lb. on small orders; San Francisco at \$38.50 per flask for domestic orders. London price is £7 10s. per flask, with £7 quoted from second hands.

**Magnesium**—The current quotation for pure metal is \$1.50 per lb. for lots of 100 lb. or over, at New York.

**Selenium**—For large lots, 100 lb. or over, \$3@3.25 per lb. is quoted; while \$5 per lb. is paid for retail orders. Exports from Baltimore for the week included 308 lb. selenium to Hamburg, Germany.

### Gold, Silver and Platinum

**Gold**—No premium is reported paid for gold on the open market in London this week, prices remaining at the Bank level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There was a good demand from the Continent, especially France and Russia, and this, with the purchases for India, took up all the supplies arriving.

Imports of gold into France in January were 49,139,000 fr.; exports, 1,963,000 fr.; leaving 47,176,000 excess of imports.

**Iridium**—There is no change, either in demand or price. Business is about as usual. Dealers ask \$75@78 per oz., New York.

**Platinum**—The market continues steady and practically unchanged. Dealers ask \$43@44 per oz. for refined platinum and \$46@49 per oz. for hard metal.

Our Russian correspondent writes, under date of Mar. 6, that there is no change in current prices. Quotations are 9.65 rubles per zolotnik at Ekaterinburg, and 37,100@37,200 rubles per pood at St. Petersburg—equal to \$36.28 and \$36.41 per oz. respectively—for crude metal, 83% platinum. No large transactions are reported. Stocks are not large and the moderate offerings of small lots from the mines are quickly taken up by buyers.

**Silver**—Our latest advices from London state that the Indian Bazaars had been accustomed so long to deal with the reckless and involved India Specie Bank that they were slow to recognize the quite different caliber of the syndicate of banks now engineering the liquidation of the surplus silver on the London market, which is being disposed of with such success.

Shipments of silver from London to the East, Jan. 11 to Mar. 5, as reported by Messrs. Pixley & Abell:

	1913	1914	Changes
India .....	£1,481,900	£1,111,000	D. £370,900
China.....	95,000	40,000	D. 55,000
Total.....	£1,576,900	£1,151,000	D. £425,900

It was officially announced in London last week that the Syndicate, which recently took over the holdings of the insolvent Indian Specie Bank, had already disposed of no less than three-fourths of its holdings.

The United States Mint has bought 200,000 oz. of silver for subsidiary coinage.

Exports of silver from France in January were valued at 31,507,000 fr.; imports were 25,591,000 fr.; leaving 5,916,000 fr. excess of exports.

### Zinc and Lead Ore Markets

#### PLATTEVILLE, WIS.—Mar. 14

The base price paid this week for 60% zinc ore was \$39@40.50 per ton. A premium of \$42 per ton was paid. The base price for 80% lead ore was \$50 per ton.

#### SHIPMENTS WEEK ENDED MAR. 14

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week .....	3,252,230	64,380	954,680
Year .....	31,257,710	1,067,100	10,870,670

Shipped during week to separating plants, 2,628,150 lb. zinc ore.

#### JOPLIN, MO.—Mar. 14

Zinc blende sold as high as \$43.50 for choice lots, the assay base ranging from \$37 to \$40.50, and the metal base from \$37 to 40 per ton of 60% zinc. The calamine base price is retained at \$21@23 per ton of 40% zinc, and the average price of all grades of zinc is \$38.54 per ton. Lead sold as high as \$53, with no change from a base of \$50 per ton of 80% metal contents, and an average for all grades of \$50.38 per ton.

Excellent weather conditions resulted in heavier outputting, despite the lower level of prices. The shipment was increased over 1000 tons and the production was fully 500 tons ahead of last week, or approximately 6000 tons. The heavy buying movement inaugurated last week was continued this week with a firm market at the week end. It is reported the National Zinc Co. will withdraw from this district the first of April.

#### SHIPMENTS WEEK ENDED MAR. 14 . . .

	Blende	Calamine	Lead	Value
Total this week . . .	11,786,370	896,010	1,506,020	\$282,275
Total eleven weeks	119,416,230	6,532,680	19,156,600	2,803,588
Blende value, the week,	\$233,880;	11 weeks,	\$2,249,900.	
Calamine value, the week,	10,460;	11 weeks,	72,685.	
Lead value, the week,	37,935;	11 weeks,	480,905.	

## IRON TRADE REVIEW

#### NEW YORK—Mar. 18

The iron and steel markets show rather less activity in the way of new orders than in February. Still a number of important structural contracts have been closed and others are pending.

The dullness in the iron and steel markets has been accentuated until the condition is one of almost stagnation. Material already ordered is readily taken, but new buying is very light and specifications have decreased.

January iron and steel exports amounted to only 119,000 tons, which represents about half the average rate of export in the past two years, and export business is now light.

Railroad buying, while below normal, is not entirely lacking. The Southern Ry. has distributed orders for 3575 cars, a very fair batch of business. There is increasing talk about the railroads having reached the physical limit in holding back orders.

The pig-iron market is quiet, so far as foundry iron is concerned. Increased activity at furnaces is mainly with the steel-works stacks. Buyers of pig iron are generally holding back and placing only moderate orders. The talk about importing pig iron does not seem to materialize in actual transactions.

The total daily capacity of the coke and anthracite furnaces in blast on Mar. 1 is reported at 71,400 tons, an increase of \$300 over the February report.

Both British and German markets are reported dull, with little new business.

#### PITTSBURGH—Mar. 17

Steel mills in the Pittsburgh and Valley districts continue to operate at about 80% of capacity, there having been no change since the middle of February. Shipping orders, however, are now coming in at a relatively low rate and the mills are losing ground, so that within 30 days they will have to curtail production unless a change occurs for the better.

The bimonthly wage adjustment in connection with the Amalgamated Association iron mill wage scale showed an average realized price on January and February bar iron shipments of 1.159c., calling for a puddling rate of \$5.70, against a settlement of 1.203c., calling for a \$5.85 rate for the preceding period.

There is no quotable change in steel prices, but the market is not being seriously tested. The mills are not actively seeking business as they find buyers in no mood to take hold. Any aggressive selling campaign would doubtless lower prices. In bars, plates and shapes there is likely to be some selling pressure developed after Apr. 1 as some large interests have been practically keeping out of the market, being comfortably filled for a limited period.

**Pig Iron**—In line with the suggestion of resale iron made in last week's report, it is now learned that a producing interest has picked up about 2500 tons of basic pig iron, at \$13, Valley, from consumers who concluded that they had overbought, and it is claimed that there is no more resale iron available at this figure. Buying by consumers is light, but shipments as a rule are being well taken. Small lots of bessemer are moving at \$14.25, but it is quite uncertain what



price a large inquiry would bring out. We quote: Bessemer, \$14.25; basic, \$13; malleable and No. 2 foundry, \$13.25; forge, \$12.75, at Valley furnaces, 90c. higher delivered Pittsburgh.

**Steel**—The market for unfinished steel is very quiet. The mills have for many weeks been quoting billets on a basis of \$21 for first quarter and \$22 for second quarter, with \$1 advance for sheet bars. When Apr. 1 is reached the market will therefore be put to a test, as there must be a virtual advance of \$1 a ton or a recession of the mills from their position. Rods are \$26@27, Pittsburgh.

**Ferromanganese**—The recently reported cutting of the \$39 price has developed into open offers, and both English and German ferromanganese are quotable at \$38@39, Baltimore, for prompt or forward. The market is quiet.

**FOREIGN IRON NOTES**

**Swedish Iron and Steel Production** for the full year is reported as follows:

	1911	1912	1913
Pig iron.....	634,400	699,800	735,000
Wrought iron.....	146,700	148,800	153,400
Country steel ingots.....	93,800	107,300	115,700
Openhearth steel ingots.....	372,700	404,100	467,100

Exports in 1913 were 207,500 tons pig iron and 295,100 tons other iron and steel, a total of 502,600 tons. There were in operation in 1913 a total of 104 blast furnaces, 210 puddling furnaces, 17 bessemer converters and 62 openhearth furnaces.

**IRON ORE**

**Imports and Exports of Iron Ore in the United States**, month of January, long tons:

	1913	1914	Changes
Imports.....	175,463	101,804	D. 73,659
Exports.....	13,896	6,422	D. 7,474

Imports of manganese ore were 55,543 tons in 1913, and 24,135 in 1914; decrease, 31,408 tons.

It is announced that the Bethlehem Steel Co. has arranged to charter from Swedish transportation interests a fleet of five steel steamships of 17,000 tons cargo capacity each, to carry iron ore from the company's Chilean holdings to Philadelphia or New York Harbor. These charters are to run for a period of 10 to 20 years and have been closed at a fixed freight rate of 11s. 6d, or \$2.80 per gross ton. The vessels are to be designed and built especially for ore carrying and will be ready to enter upon the contract in two years.

**Swedish Iron Ore Exports** for the full year 1913 were 6,459,950 tons, an increase of 919,297 tons, or 16.7%, over the preceding year.

**COKE**

Connellsville coke production for the past week is reported by the "Courier" at 345,690 tons. Shipments were heavy, being 383,342 tons, and a good deal of coke is being drawn from stock. Shipments from the Greensburg and Upper Connellsville districts were 38,950 tons.

**Connellsville Coke**—The market has become very quiet again, after recent sales of contract coke for March and second quarter at \$2. While some operators are quoting \$2.10 there is doubt whether consumers not now covered for second quarter would even consider \$2, as their own prospects are not as good as they were. Prompt coke is easier, and can readily be had at \$1.90 in odd lots.

**Imports and Exports of Fuel in the United States** in the month of January, in long tons:

	Exports		Imports	
	1913	1914	1913	1914
Anthracite.....	305,599	197,415	5	106
Bituminous.....	975,963	923,760	126,295	112,303
Coke.....	81,110	66,720	6,617	7,188
Bunker coal.....	612,689	607,652		
Total.....	1,975,331	1,795,547	132,917	119,597

The bunker coal, or coal furnished to steamships in foreign trade, is practically all bituminous. The largest trade, both exports and imports, is with Canada.

**CHEMICALS**

**NEW YORK—Mar. 18**

The general market appears to be rather quiet, though there is a fair trade going on in most lines.

**Arsenic**—There is no interest in the market, as under recent arrangements producers supply the consumers directly.

The price is practically fixed for the present at \$3 per 100 lb. for spot.

**Copper Sulphate**—Business is not specially active and prices are steady. Current quotations are \$4.80 per 100 lb. for carload lots, and \$5.05 for smaller parcels.

**Nitrate of Soda**—The market is firm and steady, both here and abroad. Quotations are unchanged at 2.25c. per lb. for both spot and future positions.

**Potash Salts**—Exports from Germany for the 12 months ended Dec. 31 are reported as follows, in metric tons:

	1912	1913	Change
Crude potash salts.....	1,300,457	1,676,156	I. 375,699
Potassium chloride.....	286,614	293,320	I. 6,706
Potassium sulphate.....	85,479	133,258	I. 47,779
Pot.-magnesium sulphate.....	48,600	59,207	I. 10,607
Totals.....	1,721,150	2,161,941	I. 440,791

Of the exports in 1913 a total of 1,149,623 tons, or 53.2%, went to the United States.

**COPPER SMELTER'S REPORTS**

This table is compiled from reports received from the respective companies except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield then is reckoned at 97%. In computing the total American supply duplications are excluded.

	October	November	December	January	February
Alaska shipments.....	1,951,883	3,391,300	3,104,155	2,701,258	1,803,579
Anaconda.....	18,400,000	25,250,000	25,100,000	24,400,000	21,300,000
Arizona, Ltd.....	3,550,000	2,800,000	2,920,000	3,474,000	3,062,000
Copper Queen.....	8,292,929	7,115,991	9,033,459	8,796,358	6,987,366
Calumet & Ariz.....	4,500,000	4,600,000	5,230,000	5,975,000	5,596,850
Chino.....	4,767,466	4,270,821	4,390,018		
Detroit.....	1,861,878	1,922,352	2,021,034	1,590,681	1,814,214
East Butte.....	1,040,997	1,002,190	1,324,560	1,256,000	1,193,960
Giroux.....	156,084	250,000	197,649	148,411	
Mason Valley.....	1,052,000	1,174,000	1,372,000	944,000	
Mammoth.....	1,700,000	1,700,000	1,400,000	1,625,000	1,400,000
Nevada Con.....	5,898,046	5,443,647	5,343,862	5,791,122	
Ohio.....	698,691	772,120	722,940	700,728	
Old Dominion.....	2,037,000	2,450,000	2,613,039	2,797,000	3,066,000
Ray.....	4,725,419	4,753,964	5,075,202	5,705,000	5,432,000
Shannon.....	1,216,000	1,110,000	1,078,000		904,000
South Utah.....	232,269	225,072	242,362	275,599	
Tennessee.....	1,392,162	1,666,753	1,700,000	1,474,890	
United Verde.....	3,000,000	3,000,000	3,000,000		
Utah Copper Co.....	9,929,478	10,787,426	10,306,646	10,329,564	10,329,565
Lake Superior*.....	5,500,000	6,000,000	5,600,000	7,400,000	8,500,000
Non-rep. mines*.....	6,200,000	6,000,000	6,250,000		
Total prod.....	88,102,302	96,285,636	98,024,926		
Imp., bars, etc.....	21,935,023	21,796,866	23,578,938		
Total blister.....	110,037,325	118,082,502	121,603,864		
Imp. ore & matte.....	5,062,015	8,980,186	12,205,187		
Total Amer.....	115,099,340	127,062,688	133,809,051		
Miami†.....	2,862,050	3,230,000	3,210,000	3,258,950	3,193,300
Shattuck-Arizona.....	993,224	995,429	1,050,781	1,276,636	
Brit. Col. Cos.....					
British Col. Cop.....	688,581	655,637			
Granby.....	1,718,258	1,944,145	1,605,382	1,793,840	
Mexican Cos.....					
Boleof.....	2,424,800	2,315,040	2,315,040	2,369,920	1,984,080
Cananea.....	3,682,000	3,800,000	3,646,000	3,400,000	2,688,000
Moctezuma.....	3,178,136	3,517,800	3,139,613	3,024,556	2,642,543
Other Foreign.....					
Braden, Chile.....	2,006,000	1,592,000	2,122,000	2,430,000	2,362,000
Cape Cop., S. Af.....	712,320	649,600	683,200	519,680	
Spassky, Russia.....	983,360	904,960	900,480	902,720	
Exports from.....					
Chile.....	6,160,000	7,616,000	10,640,000	5,488,000	6,720,000
Australia.....	7,728,000	11,200,000	6,720,000	5,712,000	7,952,000
Arrivals—Europe‡.....	18,040,960	9,107,840	13,787,200	8,599,360	18,354,560

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.  
‡ Does not include the arrivals from the United States, Australia or Chile.

**STATISTICS OF COPPER**

Month	United States			Visible Stocks.		
	U.S. Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
Year 1912	1,581,920,287	819,665,948	746,396,452			
III '13	136,251,849	76,585,471	77,699,306	122,302,890	81,244,800	203,547,690
IV.....	135,353,402	78,158,837	85,894,727	104,269,270	87,180,800	191,450,070
V.....	141,319,416	81,108,321	68,285,978	75,549,108	85,948,800	161,497,908
VI.....	121,860,853	68,362,571	68,067,901	67,474,225	77,235,200	144,709,425
VII.....	138,074,602	58,904,192	78,480,071	52,814,606	77,904,000	124,808,606
VIII.....	131,632,362	73,649,801	73,263,469	53,594,945	66,420,480	120,015,385
IX.....	131,401,229	66,836,897	73,085,275	38,314,037	63,716,800	102,030,837
X.....	139,070,481	68,173,720	68,123,473	29,793,094	53,625,600	83,418,692
XI.....	134,087,708	48,656,858	70,067,803	32,566,382	48,787,200	81,353,582
XII.....	138,990,421	21,938,570	73,542,413	47,929,429	46,592,000	94,521,429
Yr., '13	1,622,450,829	767,261,760	860,062,784			
I, 1914	131,770,274	47,956,955	87,955,501	91,438,867	53,916,800	145,355,667
II.....	122,561,007	47,586,657	83,899,183	87,296,685	50,108,800	137,405,485
III.....				78,371,852	47,376,000	125,747,852

Note—Visible supplies in Europe do not include copper afloat.

Assessments

Company	Delinq.	Sale	Amt.
Alpine Galena, Utah.....	Mar. 6	Mar. 26	0.0015
Andes, Nev.....	Mar. 6	Mar. 27	0.03
Belmont, Ida.....	Feb. 28	Mar. 24	0.003
Big Elk, Ida.....	Mar. 16	Apr. 2	0.001
Buclimo, Calif.....	Feb. 24	Mar. 24	0.03
C. & R., Ida., postp'd.....	Mar. 24	Mar. 24	0.005
Copper Butte, Utah.....	Mar. 2	Apr. 2	0.00125
Crown Point, Nev.....	Mar. 2	Mar. 23	0.10
Crown Pt., Utah.....	Mar. 14	Apr. 3	0.005
Dugway Bonanza, Utah.....	Mar. 14	Apr. 4	0.005
Eagle's Nest.....	Mar. 20	Apr. 3	0.005
Empire, Ida., postponed.....	Apr. 2	Apr. 2	0.005
Exchequer, Nev.....	Mar. 4	Mar. 25	0.02
Galena King, Utah.....	Mar. 6	Mar. 26	0.0015
Gould & Curry, Nev.....	Mar. 10	Mar. 30	0.03
Grutli, Utah.....	Mar. 11	Mar. 28	0.002
Idaho-Nevada, Ida.....	Mar. 7	Apr. 1	0.001
Moonlight, Ida.....	Feb. 28	Mar. 28	0.005
Nabob, Ida.....	Feb. 23	Mar. 23	0.005
Nebo National, Utah.....	Mar. 10	Mar. 31	0.001
Ploche Coalition, Nev.....	Mar. 10	Mar. 30	0.05
Secret, Utah.....	Mar. 10	Mar. 30	0.00125
Sheba, Utah.....	Feb. 5	Mar. 31	0.05
Sierra Nevada, Nev.....	Mar. 2	Mar. 25	0.10
Sunset, Ida.....	Mar. 7	Mar. 28	0.0015
Tarbox, Ida., postp'd.....	Mar. 28	Mar. 28	0.002
Yankee Cons., Utah.....	Mar. 7	Mar. 23	0.02

Monthly Average Prices of Metals  
SILVER

Month	New York			London		
	1912	1913	1914	1912	1913	1914
January.....	56.260	62.938	57.572	25.887	28.983	26.553
February.....	59.043	61.642	57.506	27.190	28.357	26.573
March.....	58.375	57.870	.....	26.875	26.669	.....
April.....	59.207	59.490	.....	28.284	27.416	.....
May.....	60.880	60.361	.....	28.038	27.825	.....
June.....	61.290	58.990	.....	28.215	27.199	.....
July.....	60.654	58.721	.....	27.919	27.074	.....
August.....	61.606	59.293	.....	28.375	27.335	.....
September.....	63.078	60.640	.....	29.088	27.986	.....
October.....	63.471	60.793	.....	29.299	28.083	.....
November.....	62.792	58.995	.....	29.012	27.263	.....
December.....	63.365	57.760	.....	29.320	26.720	.....
Year.....	60.835	59.791	.....	28.042	27.576	.....

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

COPPER

Month	New York				London Standard	
	Electrolytic		Lake		1913	1914
	1913	1914	1913	1914		
January.....	16.488	14.223	16.767	14.772	71.741	64.304
February.....	14.971	14.491	15.253	14.946	65.519	65.259
March.....	14.713	.....	14.930	.....	65.329	.....
April.....	15.291	.....	15.565	.....	68.111	.....
May.....	15.436	.....	15.738	.....	68.807	.....
June.....	14.672	.....	14.871	.....	67.140	.....
July.....	14.190	.....	14.563	.....	64.166	.....
August.....	15.400	.....	15.904	.....	69.200	.....
September.....	16.328	.....	16.799	.....	73.125	.....
October.....	16.337	.....	16.913	.....	73.383	.....
November.....	15.182	.....	16.022	.....	68.275	.....
December.....	14.224	.....	14.904	.....	65.223	.....
Year.....	15.269	.....	15.686	.....	68.335	.....

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

TIN

Month	New York		London	
	1913	1914	1913	1914
January.....	50.298	37.779	238.273	171.905
February.....	48.766	39.830	220.140	181.556
March.....	46.832	.....	213.615	.....
April.....	49.115	.....	224.159	.....
May.....	49.038	.....	224.143	.....
June.....	44.820	.....	207.208	.....
July.....	40.260	.....	183.511	.....
August.....	41.582	.....	188.731	.....
September.....	42.410	.....	193.074	.....
October.....	40.462	.....	184.837	.....
November.....	39.810	.....	180.869	.....
December.....	37.635	.....	171.786	.....
Av. year.....	44.252	.....	206.279	.....

New York in cents per pound; London in pound sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January.....	4.321	4.111	4.171	4.011	17.114	19.665
February.....	4.325	4.048	4.175	3.937	16.550	19.606
March.....	4.327	.....	4.177	.....	15.977	.....
April.....	4.351	.....	4.242	.....	17.597	.....
May.....	4.342	.....	4.226	.....	18.923	.....
June.....	4.325	.....	4.190	.....	20.226	.....
July.....	4.353	.....	4.223	.....	20.038	.....
August.....	4.624	.....	4.550	.....	20.406	.....
September.....	4.698	.....	4.579	.....	20.648	.....
October.....	4.402	.....	4.253	.....	20.302	.....
November.....	4.293	.....	4.146	.....	19.334	.....
December.....	4.047	.....	3.929	.....	17.798	.....
Year.....	4.370	.....	4.238	.....	18.743	.....

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

SPELTER

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January.....	6.931	5.262	6.854	5.112	26.114	21.583
February.....	6.239	5.377	6.089	5.227	25.338	21.413
March.....	6.078	.....	5.926	.....	24.605	.....
April.....	5.641	.....	5.491	.....	25.313	.....
May.....	5.406	.....	5.256	.....	24.583	.....
June.....	5.124	.....	4.974	.....	22.143	.....
July.....	5.278	.....	5.128	.....	20.592	.....
August.....	5.658	.....	5.508	.....	20.706	.....
September.....	5.694	.....	5.444	.....	21.148	.....
October.....	5.340	.....	5.188	.....	20.614	.....
November.....	5.229	.....	5.083	.....	20.581	.....
December.....	5.150	.....	5.004	.....	21.214	.....
Year.....	5.648	.....	5.504	.....	22.746	.....

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

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1913	1914	1913	1914	1913	1914
January.....	\$18.15	\$14.94	\$17.35	\$13.29	\$18.59	\$13.90
February.....	18.15	15.06	17.22	14.12	18.13	14.09
March.....	18.15	.....	16.96	.....	17.53	.....
April.....	17.90	.....	16.71	.....	16.40	.....
May.....	17.68	.....	15.80	.....	15.40	.....
June.....	17.14	.....	15.40	.....	15.10	.....
July.....	16.31	.....	15.13	.....	14.74	.....
August.....	16.63	.....	15.00	.....	14.88	.....
September.....	16.65	.....	15.04	.....	14.93	.....
October.....	16.60	.....	14.61	.....	14.80	.....
November.....	16.03	.....	13.91	.....	14.40	.....
December.....	15.71	.....	13.71	.....	14.28	.....
Year.....	\$17.09	.....	\$15.57	.....	\$15.77	.....

STOCK QUOTATIONS

COLO. SPRINGS Mar. 17		SALT LAKE Mar. 17	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia.....	.02	Beek Tunnel.....	.05
Cripple Crk Con.....	\$.007	Black Jack.....	.06
C. K. & N.....	.07	Cedar Fallsman.....	.01
Doctor Jack Pot.....	.06	Colorado Mining.....	.10
Elkton Con.....	.45	Crown Point.....	.01
El Paso.....	1.90	Daly-Judge.....	5.10
Findlay.....	\$.02	Gold Chain.....	.14
Gold Dollar.....	.03	Grand Central.....	.55
Gold Sovereign.....	\$.01	Iron Blossom.....	1.22
Golden Cycle.....	\$1.50	Little Bell.....	.15
Isabella.....	.10	Lower Mammoth.....	.01
Jack Pot.....	.06	Mason Valley.....	2.00
Jennie Sample.....	.04	May Day.....	.07
Jerry Johnson.....	.03	Nevada Hills.....	.35
Lexington.....	.003	Prince Con.....	.19
Old Gold.....	.01	Silver King Coal'n.....	3.20
Mary McKinley.....	.54	Silver King Cons.....	1.60
Pharmacist.....	\$.008	Sioux Con.....	.02
Portland.....	1.08	Uncle Sam.....	.05
Vindicator.....	.04	Yankee.....	.04

TORONTO Mar. 17

Name of Comp.	Bid.	Name of Comp.	Bid.
Bailey.....	.04	Foley O'Brien.....	.35
Coniagas.....	7.90	Hollinger.....	16.35
Peterson Lake.....	.42	Imperial.....	.02
Right of Way.....	.05	Jupiter.....	.17
T. & Hudson Bay.....	70.00	Pearl Lake.....	.08
Timiskaming.....	.21	Porcup. Gold.....	.12
Wettlaufer-Lor.....	.06	Preston E. D.....	.02
Big Dome.....	13.50	Rea.....	.17
Crown Chartered.....	.00	Swastika.....	.04
Dome Exten.....	.11	West Dome.....	.14

SAN FRANCISCO Mar. 17

Name of Comp.	Bid.	Name of Comp.	Bid.
Comstock Stocks.....	.09	Misc. Nev. & Cal.	7.75
Alta.....	\$.40	Belmont.....	1.10
Belcher.....	.09	Jim Butler.....	.09
Best & Belcher.....	.60	MacNamara.....	.36
Caledonia.....	.10	Midway.....	1.00
Challenge Con.....	.02	Mont-Tonopah.....	.38
Chollar.....	.40	North Star.....	.96
Confidence.....	.04	West End Con.....	.35
Con. Virginia.....	\$.55	Booth.....	.07
Crown Point.....	.04	C.O.D. Con.....	.09
Gould & Curry.....	1.10	Comb. Frac.....	.28
Hale & Norcross.....	.70	Jumbo Extension.....	.37
Mexican.....	.58	Pitts.-Silver Peak.....	.34
Ocidental.....	.21	Round Mountain.....	.08
Ophir.....	.02	Sandsform Kendall.....	.07
Overman.....	.06	Silver Pick.....	\$.27
Potosi.....	.15	Argonaut.....	\$.90
Savage.....	.13	Bunker Hill.....	.68
Sierra Nevada.....	.44	Central Eureka.....	\$.75
Union Con.....	.....	St. Eureka.....	.....
Yellow Jacket.....	.....	.....	.....

N. Y. EXCH. Mar. 17

Name of Comp.	Cig.
Amalgamated.....	74
Am. Sm. & Ref. com.....	69
Am. Sm. & Ref. pf.....	103
Am. Sm. Sec. pf. B.....	83
Anacoda.....	35
Batoplas Min.....	1
Bethlehem Steel, pf.....	85
Chino.....	41
Federal M. & S., pf.....	36
Great Nor., ore, ctf.....	37
Guggen. Exp.....	55
Homestake.....	120
Inspiration Con.....	17
Miami Copper.....	23
Nat'l Lead, com.....	49
National Lead, pf.....	108
Nev. Consol.....	15
Pheips Dodge.....	183
Pittsburg Coal, pf.....	91
Quicksilver, pf.....	21
Ray Con.....	21
Republic I&S, com.....	26
Republic I&S, pf.....	88
SlossSheff'd, com.....	31
Sloss Sheffield, pf.....	91
Tennessee Copper.....	34
Utah Copper.....	54
U. S. Steel, con.....	64
U. S. Steel, pf.....	110
Va. Car. Chem., pf.....	105

N. Y. CURB Mar. 17

Name of Comp.	Cig.
Ariz. Belmont.....	\$.03
Barnes King.....	\$.11
Beaver Con.....	.32
Big Four.....	.14
Boston Montana.....	.7
Braden Copper.....	8
B. C. Copper.....	1
Buffalo Mines.....	1
Can. G. & S.....	.05
Caribou.....	.71
Con. Ariz. Sm.....	.50
Coppermines Cons.....	.21
Davis-Daly.....	.11
Diam'field-Daisy.....	.04
Ely Con.....	.04
Florence.....	.69
Gold Hill Con.....	.45
Goldfield Con.....	.11
Greene Cananea.....	.36
Greenwater.....	.06
Internat. S. & R.....	1.06
Kerr Lake.....	.41
La Rose.....	.11
McKinley-Dar-Sa.....	.90
Mines of Am.....	.21
New Utah Bingham.....	.62
Nipissing Mines.....	.61
Ohio Copper.....	.1
Oro.....	.16
Puebla S. & R.....	.21
South Utah M&S.....	\$.25
Stand'd Oil of N.J.....	417
Stand'd Silver Lead.....	1
Stewart.....	1
Tonopah.....	.7
Tonopah Ex.....	1
Tonopah Merger.....	.50
Tri-Bullion.....	1
Tularosa.....	\$.76
United Cop., pf.....	.21
Yukon Gold.....	3

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Name of Comp.	Cig.
Adventure.....	1
Amheek.....	290
Alaska Gold M.....	22
Algoma.....	1
Allouez.....	40
Am. Zinc.....	19
Ariz. Com., cts.....	5
Bonanza.....	.50
Boston & Corbin.....	\$.50