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Phelps-Dodge in the Burro Mountains

BY FARIS V. BUSH*

SYNOPSIS—Description of the work being carried on in this New Mexico copper district by the Burro Mountain Copper Co., a Phelps-Dodge company. Development work includes a long adit. Ore produced in development is tested in a small flotation plant. A concentrator of 1000 tons capacity and a power plant are under construction. Mine water is now run through precipitation flume. Character of the ore.

Within a year activity in general in the Burro Mountain mining district, Grant County, N. M., has increased

the Burro Mountain Copper Co., situated at Leopold. This deal included the famous St. Louis mine, and also the Boston and Samson mines, with many developed orebodies. A 300-ton concentrating mill was transferred to the new operators, but it could not be operated economically and was dismantled, part of the machinery being sent to Tyrone. Later, Phelps-Dodge purchased the property of the Chemung Copper Co. and of other claim holders in the region. They now have, at a close estimate, 5000 acres of the best mining property in the section, with approximately 10 miles of underground



TWO VIEWS OF THE FLOTATION EXPERIMENTAL PLANT OF THE BURRO MOUNTAIN COMPANY

more than 50% over that of any previous year, the result of the operations of the Burro Mountain Copper Co., a subsidiary of Phelps, Dodge & Co., which has constructed a 15-mile railroad to Tyrone from White-water, the latter a point 17 miles below Silver City on the Santa Fe's branch from Deming. This railroad was built in 1913, and a regular schedule put into effect early in 1914. The road is conducted as a branch of the El Paso & Southwestern, which is also under Phelps-Dodge control.

ENTRANCE OF PHELPS-DODGE

Phelps, Dodge & Co. came into the Burro Mountain district in 1904, when they purchased the property of

*Mining engineer, Silver City, N. M.

workings. The claims are situated on the northeastern slope of the Burro Mountains, in the foothills running toward the Mangas Valley, in a rough country where the rock in general is exposed. The three peaks of Burro Mountain proper, rising to a height of 8000 ft. above sea level and visible for many miles, form a picturesque background.

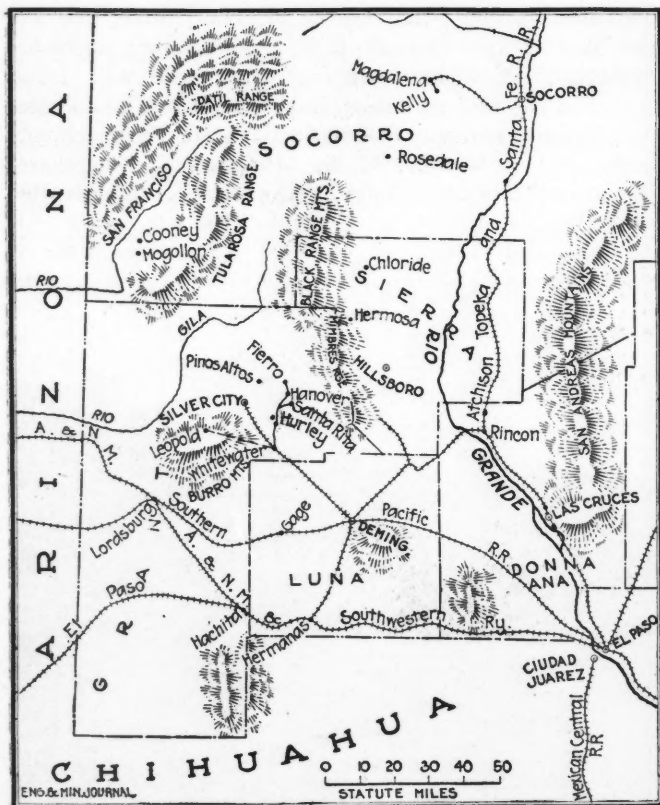
GEOLOGY

A large granite mass occupies an extensive area in the district. It is coarse grained, markedly porphyritic, and is intruded by rock of similar character. At the contact of this granite and the quartz monzonite, there are found the orebodies, which vary from 100 ft. in length and 400 ft. in width to 1500 ft. in length and 800 ft.

in width. The deposition of the ore is governed by fractures and the bodies of greatest richness are found in the zones where the fracturing has been the greatest. The fractures have a northeast-southwest trend and are believed to be deepest toward the east (Tyrone). The ore now encountered consists of copper sulphides chiefly chalcocite, the result of secondary enrichment; the ore is termed a low-grade porphyry and runs from 2½% to 4% in copper.

UNDERGROUND WORK

At Tyrone there are three shafts, Nos. 1, 2 and 3, and the Niagara haulage tunnel, which at the time of writing had been driven 4700 ft. and connected with workings at Leopold. The No. 2 shaft is about 800 ft. deep and is flooded up to the 400-ft. level. The No. 3 shaft, located half a mile up the same gulch, is about 400 ft. in depth and is also flooded. The water from these mines is pumped into precipitation flumes, sev-



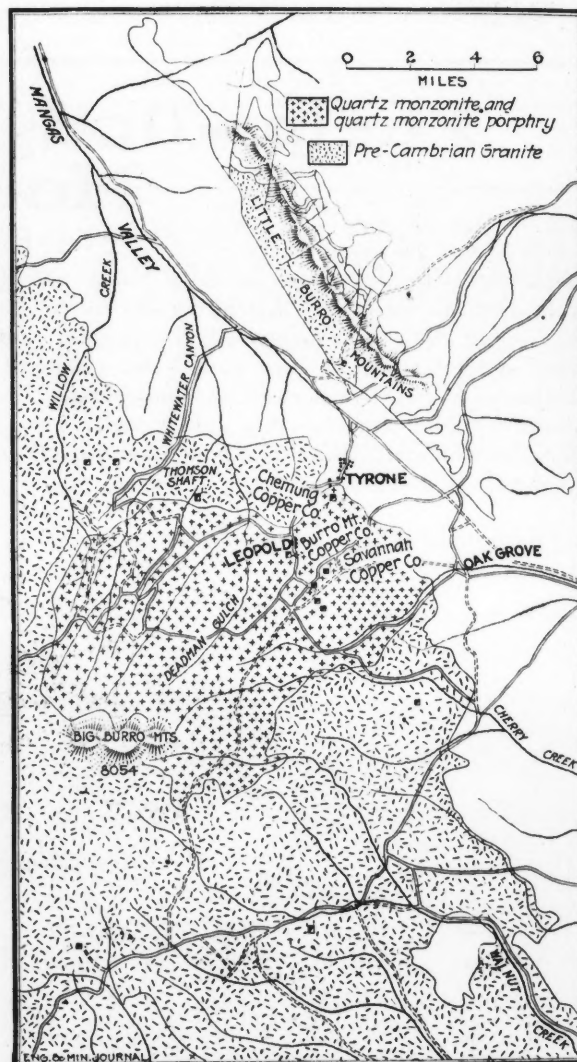
KEY MAP TO BURRO MOUNTAIN REGION

eral miles in length. This has solved the water supply question, as enough can be pumped to supply the 1000-ton mill and any other operations needing water. The Niagara haulage tunnel is located between the No. 2 and No. 3 shafts and extends southwest. A standard-gauge track will be laid in this tunnel and electric locomotives will be used to haul the ore to the portal. A large body of low-grade sulphide ore was discovered through drifts and winzes in this adit.

It was stated by the management of the Burro Mountain Co. that some form of the caving method of mining would be used in the future operation of the Tyrone and Leopold mines. The only ore so far extracted has been in development work. Actual commercial mining will begin when the method of ore concentration has been solved.

SURFACE PLANT

An ore-testing plant was erected near the portal of the main adit, and is now being run day and night, especially testing oil flotation. The plant is equipped with a Blake jaw crusher, Fraser & Chalmers rolls, Wilfley tables, a Hardinge conical mill and one oil-flotation unit of the Minerals Separation process. It was stated that as yet no conclusions had been arrived at regard-



GEOLOGY AND TOPOGRAPHY OF BURRO MOUNTAIN REGION AFTER U. S. GEOLOGICAL SURVEY

ing the success of oil flotation, and that it would be given a lengthy trial before a decision would be made. The company is well pleased with the regrinding work of the Hardinge mill. The experimental treatment plant was designed by Doctor Sandberg, of Bisbee, Ariz. The result of the methods employed in the experimental mill will govern the installation of the equipment to be embodied in the 1000-ton concentrator.

Excavation is under way at the site of the large mill, three miles northeast of Tyrone, and construction work is about to begin. A townsite has been surveyed near the mill and buildings are in course of erection. The mill water supply has already been mentioned, but if at any time this supply is not sufficient a pipe line from wells at the head of the Mangas Valley is planned.

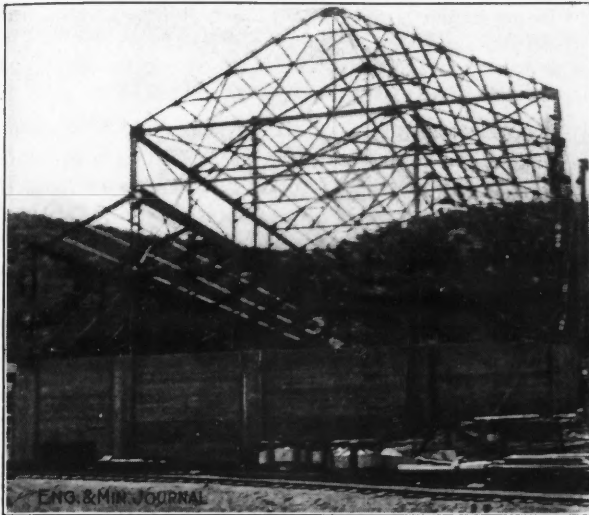
Steel construction is now being carried on at the

power plant near the No. 2 shaft. The foundations for the plant are concrete. The equipment will include two 1000-hp. Diesel engines, and power will be furnished to both mill and mines. Part of the equipment is on the ground. Electric hoists will be installed at the mines and steel headframes erected.

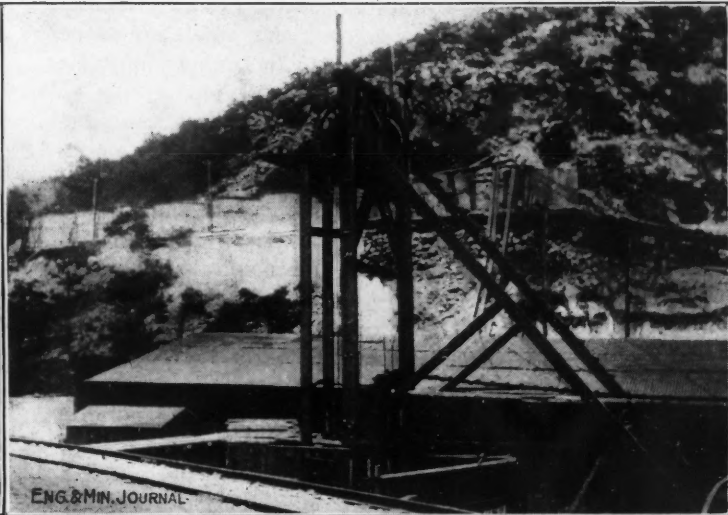
There was one churn drill in operation at the time

Over 200 men are now on the company's payrolls, engaged in development work, experimental mill operations, excavations, etc. There will be three townsites, one at Tyrone, one near the concentrator, and the old camp of Leopold.

E. M. Sawyer is general superintendent of the Burro Mountain company and has charge of all construction



THE STEEL FRAME OF THE NEW POWER PLANT



HEADFRAME OF NO. 2 SHAFT



PORTAL OF THE 5000-FT. NIAGARA TUNNEL



THE PRECIPITATION FLUME

of visiting, but two more were to be added and the new property fully prospected.

In regard to the quantity of ore blocked out it is said that there is a sufficient quantity to warrant the construction of a mill of 1000 tons daily capacity, and at present the company is not looking ahead to anything larger.

work and operations in general. E. J. Fraser-Campbell is chief engineer. While the Burro Mountain region is held by many companies and individuals, and excellent opportunities are offered men with the brains and means to make paying mines, the Phelps-Dodge company is the only one now engaged in actual large-scale operations.

Butte and Lead Contrasted

A greater contrast in conditions in two mining camps would be difficult to discover than that developed by the United States Commission on Industrial Relations at Lead, S. D., and Butte, Mont., says a special correspondent of the New York *Evening Post*. The commission is now at Seattle, and is going down the Pacific Coast.

Differences in the two mining camps, Lead and Butte, were many. In Lead a man can't get a job unless he signs an agreement not to belong to the union; in Butte he can't hold his job unless he carries a union card.

Incomparably superior physical conditions were discovered in Lead. The miners working in the famous Homestake mine pay \$1 a month into a hospital fund. Every man receives a thorough examination before going to work, and an excellent hospital is at his disposal, where he and his family receive treatment for all physical ailments. Conditions underground are especially fine, and everything looking to the physical well-being of the miners seems to have been done. The only condition is that he shall have nothing to say about it himself.

The Butte miners also pay \$1 a month into a hospital fund, as in Lead. This is required of them by the company, but there is no medical inspection in Butte. The hospital, which receives from \$6000 to \$8000 a month from the miners, will treat them only for injuries and non-contagious diseases, and will not treat their families at all. Tuberculosis is said to be prevalent among the miners, but the hospital doctors will not treat them for that, for they say it is a contagious disease. Underground conditions in Butte are said to have an influence on the tuberculosis death rate, although the company is doing a great deal to provide better ventilation, spending \$275,000 last year for this purpose.

WORK SEVEN DAYS A WEEK

In both Lead and Butte the mines are operated in three 8-hr. shifts, seven days a week. At first thought the commission seemed inclined to blame the companies for requiring men to work seven days a week; the testimony developed, however, that the miners themselves, even when organized as in Butte, insist upon doing so.

The most interesting testimony in Butte centered about the events leading up to the riotous scenes enacted there in June. It will be remembered that on June 13, which is a holiday in Butte known as Miners' Union Day, a comparatively small number of miners marched in the parade, and others, numbering thousands, attacked the parade, broke it up and blew up the union building, after which they took the safe from the building, blew it open, took the money and organized a new and independent union. Ten days later, when Charles H. Moyer, president of the Western Federation of Miners, tried to hold a meeting in Miners' Union Hall in order to effect a reconciliation, a battle occurred between the members of the old union and the insurgents. The latter blew up the building with dynamite, and Moyer and his friends barely escaped with their lives by going through a rear window and hastening out of town in an automobile.

The new union says that it has in its membership between 5000 and 6000 miners, or over 90% of the miners in Butte. Those remaining in the Western Federation concede 75% to the new union.

To the surprise of all who have known the Western

Federation of Miners by reputation, the charge of the insurgents is that the Butte local has been dominated in every respect by the Anaconda Copper Mining Co. Company domination and excessive assessments levied against their will, are the two chief grievances of the Butte miners. During the past year assessments and dues have for months run from \$4.50 to \$5 a month, and it is claimed that these assessments either were never voted at all or were voted in meetings that did not represent the miners of Butte.

SAY RING CONTROLLED MEETINGS

It was this matter of meetings that gave the company its opportunity to control, the insurgents claim, with a membership of 6000 or 7000 miners, not more than 700 could be packed in the Union Hall. The faction that has been in control for many years always got to the hall first and packed it with their supporters. It is claimed that "Company Men" on shifts at the time that a meeting was to be held would be released by shift bosses, and permitted to go to the meeting on company time, with instructions as to their votes. This, it is claimed, was done whenever an important matter was up for consideration.

A contributing factor to the dissatisfaction was the fact that the union seems to have been unable to secure any substantial improvements in conditions of labor for many years. The eight-hour day is a matter of law in Montana. When the Butte local was established in 1878, it fixed a wage scale for men underground at \$3.50 a day. Today the miners are getting \$3.75 under a sliding scale based on the selling price of copper with a minimum of \$3.50. Meanwhile other unions in Butte, such as plumbers and carpenters, have got their wages up to \$8 and \$9 per day. Butte is a closed-shop town in every respect. The cost of living is high, and one reason for it is the high wages paid to all classes of labor other than miners. The miners whose wages are comparatively low have supported the other unions in all of their campaigns for increased wages, and while their own wages have remained practically stationary since 1878, they are obliged to pay the prices which go with the wage scale in force in the other unions.

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Employer's Duty Concerning Co-Employees

By A. L. H. STREET

To promote the safety of employees engaged in the same line of work in such way that one is dependent upon the care exercised by another to prevent accidents, the employer must use a reasonable degree of diligence to employ only reasonably competent men, and to keep himself advised as to their continuing fitness, and not retain employees who are apt to cause injury to others. This rule of law has been lately reannounced by the Arizona Supreme Court in the case of Strinker vs. Ray Consolidated Copper Co., 141 *Pacific Reporter*, 740.

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McKenzie & Mann Are Fitting Out a Schooner at St. John's, Newfoundland, for an expedition to the Hudson Bay country to search for coal deposits. Coal outcrops have been reported at various points on Hudson Bay, but have never been explored to any extent. The object of the present prospecting is to secure a supply for the branch of the Canadian Northern to Fort Churchill on Hudson Bay.

Lead Matte Converting at Tooele

SYNOPSIS—An account of the new method of converting lead-copper matte at the International smelting plant at Tooele, Utah. The low-grade matte is converted in basic-lined vessels, 96x150 in., without the use of siliceous fluxing ores; the lead fume is recovered in a bag-house, the copper product and the heavy iron slag being transferred into the regular copper converters. This method produces a final slag low in lead, and a fume high in ZnO that does not injure the filtering bags.

In January and February of the current year, at the Tooele plant of the International Smelting Co., Tooele, Utah, a modification of the usual method of converting, for the treatment of copper-lead matte from lead blast furnaces, was developed and put into successful operation. In brief, the method consists in blowing molten matte direct from the blast furnaces in basic-lined converters, without the addition of siliceous fluxing ores, to the almost complete elimination of the lead contained, and to the production of copper bullion, the resulting lead fume being recovered by the filtration of the converter gases through woolen fume bags. The process is carried out in conjunction with the converting of reverberatory copper matte, the heavy iron slag, together with the copper precipitated, being transferred to converters blowing copper matte. The purpose of this transfer is to reduce the copper oxide formed, due to the necessary overblowing of the lead-matte charge, and to utilize, as far as possible, the value of iron from the lead matte, for the fluxing of siliceous dry ores. The final slag from the copper converters is then skimmed off and transferred molten to a reverberatory smelting furnace treating copper ores.

In the design of the lead plant at this works, it was planned to treat the copper-lead matte from the furnaces by direct converting without reconcentration and thereby to recover the copper, silver and gold as quickly as possible. A converter plant of ample capacity, treating copper matte, already being in operation, it was only necessary to install a baghouse, a fan and the necessary flues to complete the equipment.

The baghouse constructed has a bag-cloth filtering area of 136,000 sq.ft., provided by 960 fume bags, 18 in. in diameter and 30 ft. in length. A No. 20 Sirocco fan of 180,000 cu.ft. capacity delivers the gases from the converter plant to the baghouse. The converter plant consists of five stands of horizontal, cylindrical type shells 96x150 in. in size. A common flue received the gases from all stands. The admission of outside air was mainly relied upon for cooling the gases to the desired temperature. Means were provided for bypassing gases to the stack in case of excessive temperatures. Temperature control of gases was provided for by the installation of recording thermometers.

Converting operations were begun in February, 1913, with the baghouse equipped with woolen fume bags of cross-woven fabric, 24 threads to the inch, warp and filling. As regards the converting operation itself, test runs had shown that no difficulties attended the handling of this type of matte and operations were conducted in a manner parallel to the treatment of copper matte. For a

Note—Excerpts from a paper by Oscar Kuchs read at the Salt Lake meeting of the American Institute of Mining Engineers, August, 1914.

period of two months no difficulties were encountered. The production of byproducts, however, appeared as a disadvantageous feature. The passage of 45% of the lead contained in the matte, to the slag, necessitated its retreatment in the blast furnaces.

Baghouse difficulties began after several months of operation. Leakage developed first through perforations at the tops of the bags. While leakage of water through a prepared roofing material, that had become affected by the converter gases, was partly responsible for this condition, it soon became apparent that the destruction of the fabric was due to condensation of acid inside the bags. This condensation manifested itself in the form of spots, first at the top and later at the bottom of the bags, five or

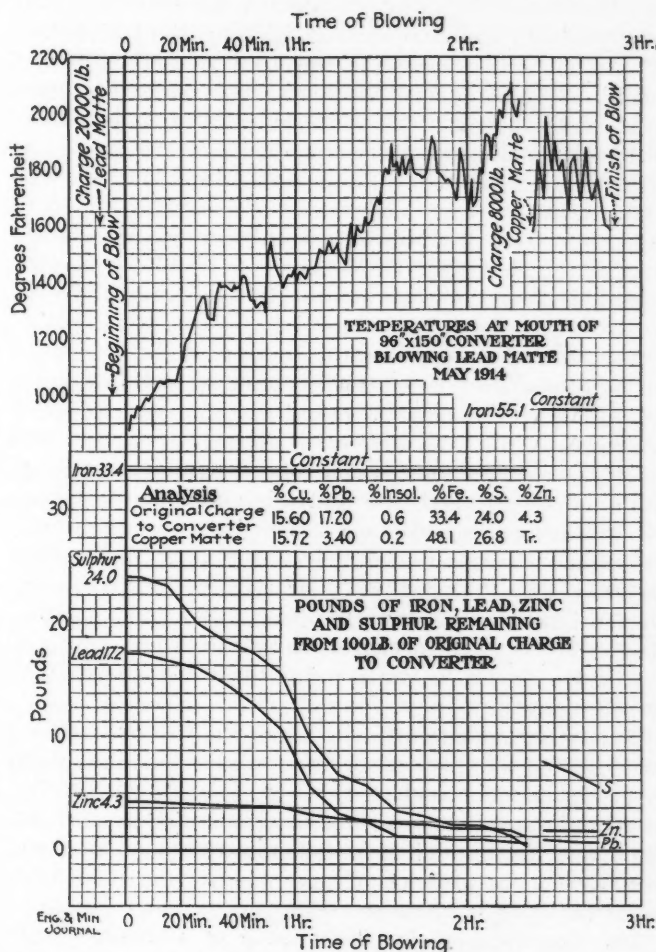


CHART SHOWING TEMPERATURE AND ELIMINATION IN LEAD-MATTE CONVERTING

six feet at each end being affected. At the points where it appeared the fabric became weakened by acid corrosion and would eventually be blown out by fan pressure, leaving enlarged perforations. The nap of the cloth was also rapidly corroded away, giving a screen-like appearance to the bags, and finally a general weakening of the whole fabric resulted in their being torn from the thimble floor. Frequent renewals of bags became necessary to prevent leakages, and inability to correct the underlying causes made it necessary to discontinue operations pending a thorough investigation of the problem.

A solution of all the difficulties required either the de-

struction of acid by the addition of a neutralizing agent, such as ZnO or CaO, or the production of a fume in itself sufficiently alkaline to preclude the formation of acid, and the production of a converter slag sufficiently low in lead to permit of its disposal by pouring back into reverberatories.

As a result of considerable experimental work, the process as outlined at the beginning of this paper was worked out. Tests carried out intermittently during the day shift in a converter set aside for the purpose showed a rapid formation of a uniform magnetite coating on the walls of the converter. It was expected that difficulty would be encountered due to the gradual closing in and reduction in capacity of the converter. This, however, under continuous operation did not develop, the crusting under these conditions being confined to the wall opposite the tuyeres, being heaviest at the mouth, due to spattering of the charge, and thinning out toward the bottom. The fume produced was more actively alkaline, the percentage of zinc eliminated from the converter as ZnO approximating 50%, as against less than 10% under the previous conditions. It was not deemed necessary, therefore, to consider adding a neutralizing agent to the gases.

Preparatory to putting the process into continuous operation, changes were made in the flue system in order that gases from lead converters only would be filtered through the baghouse. Three converter stands were consequently connected with a separate flue for lead-matte work, the remaining two stands being connected directly to the stack for copper-matte blowing. The necessity for better temperature control was realized and flues were equipped with dampers to control the admission of outside cooling air. An automatic alarm system was installed, to record by gongs and colored lamps the passing of the allowable maximum and minimum temperatures. The operating range of temperature of the gases entering the baghouse is maintained at from 210 to 230° F. The baghouse was equipped with bags from the La Porte Woolen Mills, Pendleton Woolen Mills, and Knight Woolen Mills. The former are cross-woven and have 24 threads to the inch, warp and filling; the latter is a twilled weave bag.

Converting operations were begun in February, 1914. Rather rapid building up of the converter mouth at first gave considerable trouble; however, enlargement of the mouth relieved this condition materially. Corrosion at the tuyere line proved to be somewhat more severe than results from the blowing of copper matte, and more frequent patching is necessary.

The time required for the blowing of a charge of 10 tons is about two hours, the time depending on the care given to the tuyeres. Frequent punching is necessary. A tendency on the part of the tuyeres to blind when silica is absent is very marked. Fume is evolved in dense clouds as soon as blowing begins. The volume of fume gradually diminishes after the blow is half over, and finally, if the blowing is continued long enough, fades out. The end of the blow is thus indicated by the character of the fume and flame, the flame becoming more and more visible as the fume diminishes. The charge in the converter at this stage contains about 1 to 1.5% lead and has been reduced in weight to approximately 65 to 70% of the matte charged. The fume produced under the new conditions does not seem to affect the bags materially, conditions at the baghouse being greatly improved. After three months

of operation only four bags had failed. These failures were due to apparently defective material, in that one failed through splitting at the seam and the remainder were torn, shaking of the bags appearing to have gradually opened up and extended flaws in the fabric. No acid spotting of the bags is noticeable.

To show the rate of elimination of lead, zinc and sulphur from matte and the temperatures generated when the blow is continuous and the tuyeres are kept fairly free, elimination and temperature curves applying to a single test are given in the accompanying chart. These curves are derived from data obtained during a test when copper matte was added at the end of the blow to reduce copper oxide. Iron is taken to be constant in the converter. These curves show about 75% of the lead and 65% of the sulphur are eliminated in 70 min. of a 140-min. blow. Zinc is eliminated at a fairly uniform rate throughout the blow.

The following are comparative figures of matte blown and products formed under the former practice as compared with the present practice:

1913—CONVERTING LEAD MATTE WITH THE ADDITION OF SILICEOUS FLUXING ORES

	Pb, %	Cu, %	Ag, Oz.	SiO ₂ , %	Fe, %	CaO %	S %	Zn, %
Matte.....	16.5	7.66	32.8	.....	37.4	.....	22.5	5.0
Siliceous ore.....	3.4	0.3	21.3	62.2	6.0	5.1	0.7	.....
Converter slag....	6.8	5.8	9.2	22.0	38.7	.....	3.2	.....
Baghouse fume....	63.3	1.2	5.6	1.1	.....	.....	67.5	2.5

1914—CONVERTING LEAD MATTE WITHOUT THE ADDITION OF SILICEOUS FLUXING ORES

Lead Elimination Blow:								
	Pb, %	Cu, %	Ag, Oz.	SiO ₂ , %	Fe, %	CaO %	S %	Zn, %
Lead matte.....	15.0	9.05	20.3	.....	37.9	.....	23.0	5.4
Transfer slag to copper converter	1.4	.....	.....	1.7	59.1	.....	1.8	4.0
Baghouse fumes.	64.2	0.37	5.7	0.2	0.4	.....	6.0	10.4
Copper Converter Blow:								
Copper matte....	.....	22.2	21.8	.....	41.7	.....	26.6	.....
Siliceous ores....	3.4	0.3	17.1	75.1	7.4	3.0	0.8	.....
Converter slag...	2.3	1.79	1.6	23.4	48.8	1.5	1.2	2.9

As indicated by these analyses, the converter slag from present practice can be disposed through either reverberatories or blast furnaces, depending on economic conditions. The high active alkalinity of the fume, as indicated by the percentage of ZnO present, should afford ample protection against acid corrosion for the filtering bags, the condition of the baghouse after nearly four months of operation seeming to vindicate this view.

Mechanics' Liens against Mining Property

Holding that under the statutes of Colorado liens for labor or materials furnished in the improvement of mining property are governed by the same general rules as ordinary mechanics' liens, the Colorado Court of Appeals recently decided in the case of Milwaukee Gold Mining Co. vs. Tompkins-Cristy Hardware Co., 141 *Pacific Reporter* 527, that one cannot enforce a lien for materials furnished for a mining improvement without showing that it was previously agreed that the materials should be used in the improvement of the particular premises against which the lien is sought. And it is further held that the interest of a lessor of mining property is not subject to lien on account of an improvement constructed by the lessee, unless the lessor failed to give notice that he would not be liable, after receiving knowledge that the improvement was to be made, as required by the laws of Colorado.

Mine Taxation

BY HEATH STEELE*

SYNOPSIS—The following discussion on mine taxation is to suggest a system of taxation based upon the yearly profits of a mine.

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Tax is defined as a compulsory contribution levied upon persons, business or property for the support of government. A government, particularly as we have it in this country, is a corporation of the people for the common interest of all concerned. Therefore the vital question in the promotion of the common interest is to secure funds to carry on the government in a correct proportion from all sources.

An equitable assessment of taxes has never been obtained in this country. To prove this assertion, one has to grant that there is only one correct way to accomplish an equitable assessment; then point to the tax laws of our states, all characteristically different in principle and method of levying assessments for taxation. It is easy to comprehend that the prosperity of any government depends first upon the success of its business enterprises. The value of its property is regulated by the amount of business transacted and the ability of its people to pay taxes comes only through enterprises yielding a profit. We do not need to go further than this to grasp the fact that a state or government should encourage all enterprises and do as much as it can toward securing new fields of endeavor for its people.

To encourage business in all directions and promote common interest we must not ask one branch of tax-paying enterprises to contribute a greater proportion than another, either directly or indirectly. If we as a nation or a state should pay taxes or assessments to our government and produce nothing at a profit we would soon become bankrupt. Then it stands to reason that we will inevitably do injustice to any branch of business called upon to pay more than its proportion of profits to the support of government. It may be suggested, in an argument against a direct tax on profits, that it is not right to tax one individual more than another merely because he has the ability to make a success where others fail. But, after all, is it not the successful ones by whom the government is actually maintained? So much for the tax question in general. It seems to have about exhausted the resources of the various states to arrive at some system of taxing mines on an equitable basis. It will certainly be enough for anyone eventually to work out a just system of taxation for mining and leave the solution of the problem related to other enterprises to those versed in the separate branches.

MINING AS A BASIC INDUSTRY

There is no industry save agriculture in which the human race is engaged of such importance to civilization, as mining. But as to its relative importance to a state or community, there is no other industry that will cause new areas and out of the way places to be populated, with a consequent growth of other industries, quite so quickly as mining operations. The Upper Peninsula of

Michigan, generally speaking, is not a farming country. It is probable its population and certainly its consumption of home products would be of no great consequence to the state were it not for the copper and iron mines. Take the copper district as an example, close down the mines of this district and what will become of the towns of Houghton, Hancock, Calumet and other settlements? The copper industry has not only given to this state a considerable income in direct taxes but has brought thousands of people into the state, built towns, and populated counties. It has not only opened up a large field of consumption for the products of the state within the state, but has also been the means of giving shipping facilities for local farm and manufactured products to outside markets. The state not only gets its taxes from the mines but from the towns they have built and all business enterprises connected with the towns and increased business in other parts of the state due to the mines. The taxes paid by these are the indirect taxes of the mining industry received by the state. The same is true in every section where mining operations are carried on.

Butte, Mont., if it were not for the mines, would not have its present population and resultant indirect taxes. No one disputes that California is a great state without its mines, but its beginning was due to mining and the business has played no little part in its subsequent growth. Nevada, Alaska, Arizona and others owe almost all to their mines; and whatever some of them do or may amount to in other directions, their mines will have been the most important factor in their development.

It is only necessary to pass over the importance of mining in a general way for even the laymen can realize what the industry means in any community. Mining and farming are the two basic industries for they create new wealth. Including in the former all concerns taking the products from the earth and in the latter all products raised from the soil or grown upon its fruits—there are no other branches that actually produce new wealth. Manufacturing, transporting and merchantile enterprises are only the branches of business that shape and distribute the products of the two basic branches. Therefore, is not the importance of mining a justification for an equitable method of taxation and a defense against such crude methods of assessment as are now carried on in some states?

PRESENT METHODS OF ASSESSMENT

New York, New Jersey, North Carolina, West Virginia, Alabama, Iowa, California, Oregon and Washington have no special laws providing for the valuation of mining property. Mines are appraised as other real property; viz., at its "true cash value," "true value in money," etc., depending upon the phrase used.

Pennsylvania taxes its mines on a valuation of tangible assets and to arrive at this valuation each mine is required to report its earnings, expenditures, a list of assets, a statement of lands owned, an estimate of ore supply, etc. From these data an appraisal is made.

Michigan and Minnesota assess their mines on a valuation basis, no different from the other states just named

*52 William St., New York.

except that they have used more scientific methods of valuation.

We may group all the states mentioned under one head as states taxing their mines by a physical valuation of their assets. The following may be grouped under the head of states taxing their mines on a basis of production. In this group we have two divisions. First, a system of appraisal, based upon the production, that is at best a makeshift. Second, a system of appraisal based upon the production, that is apparently the most equitable form of assessing mines now employed. In the first division of this group are Colorado and Arizona. In Colorado the assessor determines the net proceeds of a mine by deduction from the gross value of the production; the actual cost of extracting the ore from the mine, not including salaries of any person not actively and consecutively engaged in or about the mine; the actual cost of transporting the ore to place of reduction or sale. The assessed valuation of the mine is then arrived at by adding one-half the gross value of the output of the mine for the year to the net proceeds as obtained by the method just described. By gross is meant the value of the production without deducting any expenses incurred in producing, selling or reducing the ore.

In Arizona, mines and mining claims are divided into two classes: Class 1, productive mines and mining claims; Class 2, nonproductive mines and mining claims. A productive mine or claim is defined as one which after deducting the expenses of operation and such other expenses as permitted, shall yield net proceeds during the calendar year. The following costs are allowed: actual cost of active operation and management of mine; actual cost of transporting ore to the place of reduction or sale; actual cost of marketing production, including smelting and refining; expenses for betterments in or about the mine; expenses for repairs and betterments of mills and reduction works.

The following costs are not allowed: the purchase price of the mine, construction of new reduction works, salaries of any but those personally and consecutively engaged in the enterprise within the state. The value of the output is based on the average market conditions of the metals in New York. The assessment value is arrived at by taking four times the amount of the net proceeds plus 12.5% of the total value of gross proceeds. The rate on this taxable valuation is the same as on other property. In addition to this the reduction works, mills and smelter on mining claims or used in connection therewith are assessed in the same manner as other property. Surface ground of any mine used for any other purpose than mining is assessed as other real estate in the county. Non-producing mines are taxed as any other real estate.

In the second division of this group are Nevada, Idaho and Montana. In Nevada, all patented mining claims are assessed at \$500 unless it is shown that work to the amount of \$100 has been performed during the year. Improvements are assessed at the full cash value as other property in the county is assessed. A tax is levied on the net proceeds from the mines. The net proceeds are determined after deducting such charges for operating, transportation and reduction or sale of product as the Tax Commission deems proper. Under the present conditions the commission allows the following charges; actual expenditures for operations; the cost of mine plants at the rate to cover the whole life of the

mine, but in no case to allow plant investment to depreciate to less than 20% of its original cost. No charges for offices other than operating offices are allowed.

Idaho taxes the ground of mining claims at the price paid the U. S. Government therefor. Improvements are assessed at their full cash value. Net proceeds are also used as an assessment value.

The constitution of Montana provides that mines shall be taxed only upon their net proceeds. The surface of the mines is assessed at the price paid the U. S. Government for the land, which is \$5 per acre for metal mines and \$20 per acre for coal lands. In case the surface is valuable for other purposes as town lots, farm lands, etc., it is assessed at the local value of such property. The machinery and plants are taxed at their local value.

There is another system of taxation for mines known as the "tonnage tax," which has been advocated, particularly in Michigan, where it is strongly indorsed by the farming element of the "Lower Peninsula." This will be discussed later in connection with other systems.

OBJECTIONS TO VALUATION SYSTEM

To review the objections of taxation on a valuation basis let us take Michigan as an example. This state, like others named in the first group, has a law that requires mines to be assessed at their true cash value, the only difference being that after some agitation on the question of mine taxation, the legislature passed an act authorizing the State Tax Commissioners to engage a mining engineer to make an appraisal for them. Before this, appraisals had been made by the regular local assessors. In 1911, the Commission employed J. R. Finlay to make an appraisal of all mines and mineral lands within the state. As outlined by the Commission, the duty of the special appraiser was to appraise the total value of mines and mineral lands within each taxing district rather than to appraise the mines separately. Nevertheless, this valuation given each county or taxing district was proportioned as nearly as possible among the mines and mineral land owners and used for assessment purposes for the individual mines.

We have here an example of mine taxation on a valuation basis which was not only an elaboration of the system but, I believe, may be called the culmination of applying the principles of mine valuation for taxing purposes. Mr. Finlay was not employed by the state to work out a system of taxation but to appraise the mines. To do this on an equitable basis it was evident that only one theory of appraisal could be used and applied to all properties. The theory applied may briefly be stated as follows: the true cash value or present value of a mine is its average annual profits deferred, at a certain rate of interest; for a number of years representing the life of the mine or period during which a profit will be earned. This value is calculated from the following main factors:

- A—Ore reserves.
- B—Average annual production.
- C—Cost of production.
- D—Average price to be obtained for product.
- E—Average annual profit.
- F—Rate of interest or value of money.

Theoretically, this method is correct and is the one used by most engineers to arrive at a value for a mine, if all factors can be obtained or fairly assumed.

No one can dispute that a stated annual income for a certain number of years has a present value easily deter-

mined at a fixed rate of interest. If this were all for a correct appraisal, I should not question the fairness of this system of taxing. But as my idea of the principle involved requires a system which takes from each in the same proportion, there must be no liability of error in the method of assessment. Working from this point of view, let us take up each main factor as previously stated.

A—To arrive at the amount of ore to be considered in an appraisal of this kind we must not only consider fully developed ore but all indications for further extensions of orebodies beyond mine openings. Here we run into difficulties much greater than is encountered in measuring developed ore. The developed ore factor is more or less approximate, but estimates of further extensions are bound to vary greatly from fact. However, these are not the only obstacles in the way of a correct statement of ore reserves. The average content of valuable minerals is a very difficult factor to determine correctly for a large ore reserve and is in most cases a guess, regardless of elaborate sampling and inferences that may be drawn as to the uniform contents within certain blocks. The best we can do is to concede that the ore-reserve factor is an estimate consisting of two basic factors, both of which may be wrong.

B—The factor of average annual production not only serves to determine the length of life but the average annual profit. If the rate of production is greater than estimated the profit will be more or *vice versa*. *B* is dependent upon *A* and is subject to the errors in *A*.

C—The cost of production may be closely estimated. I say estimated because no matter how much of a record one may have to judge from, future expectations in connection with costs are no more infallible than the assumption of the ore-reserve factor. This is particularly true where metals of changing value are involved, for, granting the cost per ton of ore is the minimum, a lowering of the grade of metal content will increase the cost of the metal.

D—The factor of average price to be obtained for the product is a presumption and nothing else. One man's judgment may be better than another's because he has studied the supply and demand and is conversant with all market governing factors but we cannot grant him the powers of a true prophet.

E—This factor, the average annual profit expected, is a sum of all the errors in *A*, *B*, *C* and *D*, all of which will reflect in the profit. If the average price to be received for the product is a correct assumption, so far as it relates to the average price for the whole period, the average annual profits may be the sum estimated. But the present value obtained by this calculation and the present value that may be obtained at the exhaustion of the mine with the actual annual earnings as a basis will hardly be the same. This is particularly true with metals that fluctuate widely in price. If, during the first half of the operating period, the price of metal should be lower than the average used, the actual present value of the property will be less than estimated. If higher prices are secured the value will be raised. A fair check will only be made when a practically uniform price prevails or the highest prices are received during the middle of the period.

F—The rate of interest is a factor that may be adjusted to suit the individual in private work. For tax-

ation purposes the worth of money is a debatable question, but a rate should be used that will represent the actual earning power of money without special effort. If the business is hazardous, all factors of safety will properly have been provided in the basic factors.

Here it is shown that the only calculation involved in mine appraisal for which we can absolutely vouch as being correct is the deferring of the expected annual income at a fixed rate of interest. We may have errors in each of the five main factors together with those in the basic factors of which they are composed. I do not think that the most ardent advocate of mine taxation on a valuation basis will, if he considers the presumptive character of the data necessarily involved, contend that an equitable distribution of tax burdens can be accomplished by this method. It is impossible to value any mine correctly until it has been worked out, therefore, if we attempt to value a number of mines in a taxing district some will surely be assessed too high and some too low. A yearly appraisal would probably correct this fault to some extent but this involves a great amount of expert work and is likely to develop into a sort of superficial adjustment.

TONNAGE TAX

In Michigan, certain factions have advocated a tonnage tax on iron ore at a fixed rate and a tax on copper, I believe, at the rate of 0.5c. per lb. Any system that will collect from all mines a fixed amount on a tonnage or unit-of-metal basis will give about as unequal a distribution of tax burdens as could be devised. A pound of Wolverine Copper Co.'s copper is worth a great deal more to its owners than is a pound of Isle Royale's to its owners. A pound of Mass Consolidated copper has, practically speaking, been worth nothing to this company because it has cost them more to get it out than the company can sell it for. A 60% bessemer ore mined at \$3 a ton at one mine is worth more to its owners than the same ore is to the owners of another mine where it costs \$3.50 to get it out. An equitable distribution of tax could never be accomplished by this method unless a separate rate were worked out for each mine after considering its costs, grade of ore and other conditions. If the champions of tonnage tax have in mind an equal distribution of tax burdens among the mines or to devise a system through which the state will get a certain proportion of all the mines get in return for operating. Why not begin by working forward instead of backward and tax the actual profits of the mines?

TAX ON PROFITS

If we tax the profits of an industry at a fixed rate, each operator will be called upon to pay no more than his proportionate share. A rate could be established in each state that would tax the mining industry as a whole proportionately to other industries of the state. If necessary, this rate could be raised or lowered as conditions demanded. The fact is that any system of mine taxation that takes the profits as a basis will distribute tax burdens equally among the mines. The question of equal distribution in this case between mines and other industries depends upon the rate fixed by the state for the mines. If the taxes paid on plants and profits now levied by some of these states on mines amount to more than on other industries, according to the actual profits derived, the mines are not enjoying equal taxation.

TAX SYSTEM ADVOCATED

The essential requisite for the working of the system I would advocate for mine taxation is for each state to determine the ratio of its mining industry to other industries and enterprises in the state. From this, proportion to the mining industry its share of the tax burden. Then let this proportion of the tax burden allotted to the mining industry be proportioned to the separate mines in the following manner:

First—A tax upon all surface of the lands owned, the assessment to be made and a tax collected in the same manner as on other lands in the district. A minimum value per acre to be placed on all surface holdings. If the land is valuable for farming, town lots, etc., it is to be valued as such.

Second—After the surface tax has been adjusted and the total amount of taxes collectable from the mines from this source is known; a rate, to be used in taxing the yearly profits, to be established that will make up the remaining balance of the tax burden collectable from the mines. In determining the remaining balance to be made up from profits any lands used for such purposes as: dwellings for employees; stores selling general merchandise to employees or the public; or lands for any other purpose than mining, milling, or reduction works in connection with mining; are to be excluded. A tax at this fixed rate is then to be collected on all yearly profits from mining, milling or smelting operations in connection with mining. I do not mean to imply that this rate could be so accurately established that it would yield an exact sum that might be estimated beforehand. It would probably have to be made somewhat higher than indicated in order properly to provide the amount expected. Both the ratio of the mining industry to other industries and the rate of taxes on profits would no doubt have to be adjusted at times.

Third—All buildings used as dwellings for employees; store buildings or stores for general merchandise, or any business enterprise owned by mining concerns or profits from any source that is not actually a department of mining or ore-treatment operations; to be taxed as any other real estate or personal property in the district.

Fourth—All plants; mining, milling, smelting, or equipment used in connection therewith, ore reserves and untreated ore on hand to be exempt from taxation.

Fifth—Profits should be determined in the following manner:

Receipts:

- (a) Total receipts from the sale of product.
- (b) Total value of finished product on hand.
- (c) Miscellaneous receipts to operating accounts.
- (d) A deduction for product carried forward from the previous year, at the same value as given in last report.

Costs:

- (f) Actual expenditure for mining.
 - (g) Actual expenditure for transporting ore.
 - (h) Actual expenditure for treating, refining and selling product.
 - (i) Actual expenditure for current construction, such as changes and upkeep of plants and machinery.
 - (j) Depreciation of original cost of plant and equipment.
- Profit being the balance of receipts over costs.

All receipts from rents, merchandise profits, and other profits not a direct credit to operations should be excluded from receipts. In case any dwellings are furnished free of charge to employees a reasonable charge should be allowed in the costs.

The property purchase price should be excluded from

the costs as well as salaries of those not connected with active operations. Any construction work that materially increases the tonnage capacity should be charged to the original cost of plant and equipment and charged out as depreciation. Depreciation cannot be charged at the same rate for all mines, therefore, the Tax Commissioners should have full power to fix the rate in each case; however, a maximum and a minimum rate might be fixed. In no case should a company be allowed to report a profit to the state, less than the profit shown in its annual statements or reports after making allowance for outside profits excluded from the receipts in the tax statement.

The foregoing is an outline of a policy which, I believe, if adopted, would not only give to the state all it should have from the mining industry but give the mines a just tax system. The actual profits to the owners are less than outlined above as the purchase price of the property has not been included in the cost. But owing to many ways in which this account could be figured it is possibly safer not to consider it as a cost. The hazards of the business are great and the profits as figured are hardly ever more than a just return for the risks taken. The caution and good business judgment displayed by developing large ore reserves by a mining concern is certainly to be encouraged rather than made an excuse for piling on more taxes.

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The New Arizona Smeltery of the Anaconda Company*

The Arizona plant of the International Smelting & Refining Co., owns 38 acres of ground upon which a smeltery is being built, located about one mile from the Inspiration and Miami Copper Co.'s mills, whose concentrates it will treat under long-term contracts.

It will be served by a standard-gage railroad about one mile in length, having 24 sixty-ton concentrate cars in operation, also an industrial-railway system of standard gage equipped with trolley wires for motive power, also electric locomotives, cars, etc., for handling materials.

The plant will have a capacity of 900 tons per day and will consist of: A system of steel receiving bins of 1000 tons capacity; a sampling works with system of belted conveyors; three 3000-ton steel bins for smelting mixture; six 22-ft. diameter drying furnaces; three reverberatories which will be furnished with waste-heat Stirling boilers; one steel stack 300 ft. high and 22 ft. in diameter; six 12-ft. converters capable of producing 250 tons of copper per day.

There will also be suitable smelter offices and laboratories, shops, warehouses, etc., pipe lines, change house and several residence buildings. The power house for this plant will be jointly owned with the Inspiration Consolidated Copper Co. Completion of all of said additions is expected within the next 18 months, and that the plant will be in operation the early part of 1915.

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Sand and Gravel Production in 1913 in the United States was 79,555,849 tons, according to the U. S. Geological Survey. Of this 1,791,800 tons were glass sand, and 3,563,583 tons were molding sand.

*From the application of the Anaconda Copper Mining Co. to list 330,000 additional shares on the New York Stock Exchange.

Cyanide Development at Porcupine, Ontario--I*

BY HERBERT A. MEGRAW

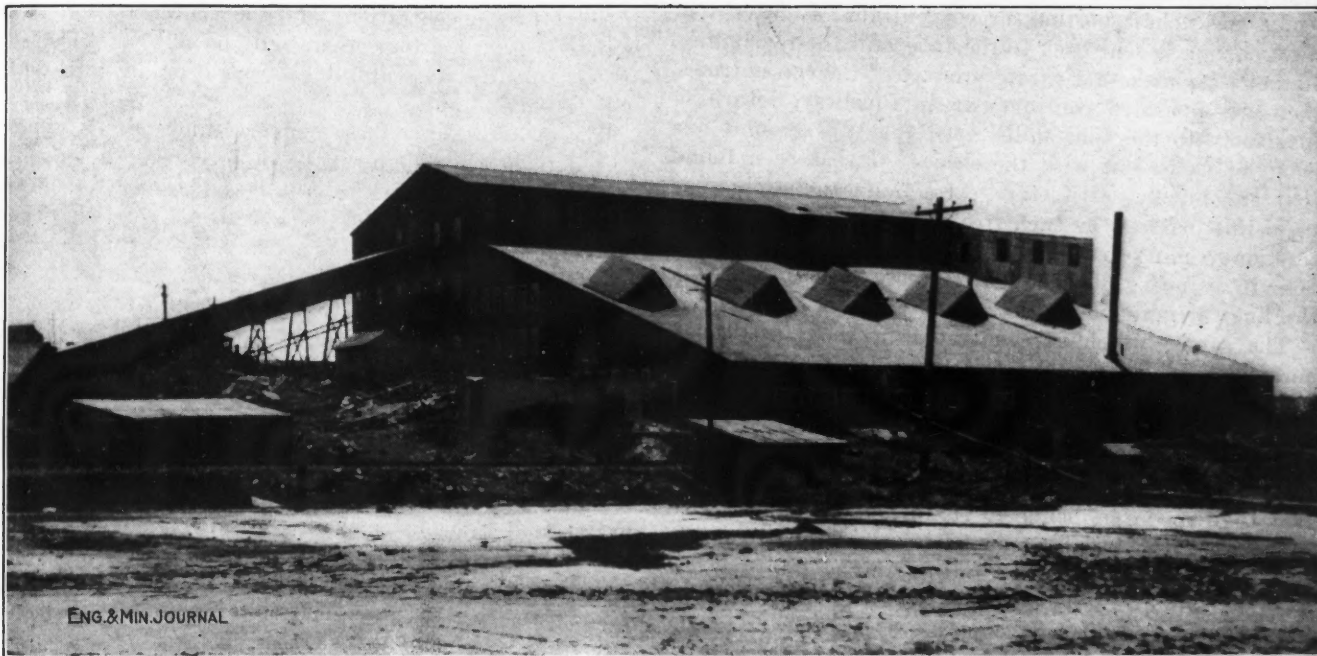
SYNOPSIS—Cyanide mills in the Porcupine district are experiencing a period of expansion and metallurgical development. The Dome mill has materially increased its treating capacity and has changed its metallurgy, adopting a separate treatment system for sands and slimes. The Hollinger is also enlarging, and is making increased use of counter-current decantation. Both are forward steps.

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The methods applied to the metallurgy of the Porcupine gold ores of Ontario, Canada, are in a constant state of change. While there is no great difficulty in the chemistry of gold recovery, there is a continual and gradual development toward improved and mechanical meth-

stallation has been doubled, the total number now in use being 80. It is a back-to-back plant, with the 40 new stamps placed in a line behind the 40 originally installed. The new stamps are of the same weight and have the same details as the old ones.

The rock-breaking system had already been changed, as described in a recent issue of the JOURNAL.¹ The ores from the preliminary breaking department are still carried to the mill upon the inclined belt conveyor, the difference being that the conveyor has been lengthened in order to account for the additional height of the battery bins, which were raised 6 ft. all around, in order to accommodate the mill supply for the larger installation. The inclined conveyor belt formerly delivered the ore into



THE DOME MILL, SOUTH PORCUPINE

ods which tend to reduce costs, while at the same time maintaining the high standard of percentage recovered. These developments have not been startling, and only in exceptional cases radical. Rather, they have been simply the day-to-day improvements upon existing methods, building up one insignificant detail upon another, until a real departure is reached.

TREATMENT CHANGE AT DOME MILL

Perhaps the most radical change to be noted in the Porcupine district is the change in the Dome mill, which has come through the necessity for enlarging it to handle a much greater quantity of ore than was possible in the original installation. It is well known that the stamp in-

the bins by means of an automatic tripper arrangement, which traveled over the bins and could be discharged at any desired point. This has now been changed, and the belt conveyor delivers into a three-legged chute, the two side legs of which discharge on two shuttle belts, by means of which the ore can be deposited in any portion of the bin, and the middle leg is occupied by a screen department, which separates the fines, under $\frac{1}{8}$ -in. mesh, and bypasses them around the stamps, so that they will go directly to the tube mills without having burdened the stamp batteries with work which they cannot economically perform.

The treatment of the crushed ores from the battery is to be altogether different from the method applied in the original mill. It will be remembered that the ore was formerly treated as an all-slime product, being reground in tube mills having a closed circuit with Dorr classifiers,

*This is the thirteenth of a second series of articles by Mr. Megraw. It deals with the comparative details of cyanide practice, discussing points of possible improvements. Preceding articles of this series appeared in the issues of Sept. 6, Oct. 4, Nov. 1, Nov. 15, Dec. 20, Jan. 31, Mar. 7, Mar. 21, Apr. 25, May 23, June 20 and July 25. The next article will deal with "Cyanide Development at Porcupine, Ontario--II," and will appear in the issue of Sept. 12, 1914.

¹"Eng. and Min. Journal," Aug. 15, 1914.

until it was all fine enough to be treated by agitation. In the new installation, only one pass through the tube mills will be given, and the sand will be separated and leached.

The mill originally contained amalgamating plates placed in front of the batteries for a preliminary amalgamation, but this has for some time been considered not altogether satisfactory. In the re-design of the mill, these plates are omitted. The pulp is passed directly to the tube mill, and from there carried to an elevator which raises the pulp to a series of amalgamating plates which are placed in the highest portion of the new addition to the mill.

SEPARATE TREATMENT OF SANDS

From the plates, the pulp is carried through large separating cones, from which the slimes are overflowed and taken directly to the agitation system. The metallurgy of slimes is in no way changed from the original plan, but receives the same treatment originally devised for the whole pulp. The sands from the separating cones are taken to a series of Merrill concentrating cones, from which the richest portion, or concentrates, is taken out. This portion is sent back to the tube mill for regrinding. Rather than make a separate product of the concentrates, they are separated continuously in this way, returning invariably to the tube mills until they are ground fine enough to pass out with the slimes. It has been found that an entirely satisfactory extraction can be obtained upon this material by such treatment, the percentage extraction seeming to depend almost entirely upon the fineness in grinding, the higher extractions accompanying the finer grindings.

The sands, which are separated in the large cones, and which go through the concentrating cones, are to be leached. They are taken to a set of large leaching tanks through a distributor of the Butters & Mein type, which deposits the sand in a leachable bed in the tank. These leaching tanks are without any special features, except that they are large, being 40 ft. in diameter and 8.5 ft. deep. The filter bed is coco matting, laid, as is usual in such cases, upon a wooden grating in the tank bottom. The bed is not exactly flat, but is slightly sloped, being high on two diametrically opposite sides, and low on the two opposite sides. This leaves a sort of a trough along one diameter of the tank, at each end of which is a side-discharge door. Upon opening these, the sand charge, saturated with water, may be sluiced out at little cost. The abundance of water, and the consequent cheapness of disposing of sand tailings in this way, is one of the important features which has led to the adoption of the process. Had the sands to be handled by manual labor, or by expensive machinery, the decision might have been otherwise. The leaching period is expected to be about five days, and in that time a high economical percentage of the contained gold is obtained. The plant has not been running long enough to furnish authoritative data as to what the results will be, but it has been calculated conservatively that there is a material saving over regrinding the sands and agitating them. While the percentage extraction may not be quite as high as with regrinding and agitation, still the much lower costs make a larger ultimate profit obtainable.

Water will still be used for the grinding and amalgamating circuit at the Dome mill as formerly, and cyanide will be added to the slimes department at the agitating

tanks, as before, while with the sands, the cyanide treatment will begin with the leaching solutions after the sands have been laid down in the tanks. The addition to the Dome mill is sufficiently large to care satisfactorily for the additional apparatus required for the new department, and the mill, as a whole, while perhaps lacking some of the conveniences and good appearances of the original plant, is nevertheless expected to be considerably more efficient than before.

EXTENSION OF HOLLINGER MILL

Another mill in the Porcupine district, which is being expanded, is the Hollinger, at Timmins. When the new installation is complete, the total will be brought up to 60 stamps. Some changes of system are being incorporated along with the new installation, and these are worthy of note. As will be remembered, the Hollinger ores are crushed in cyanide solution at the stamps and sent directly to the tube mills, in closed circuit with Dorr classifiers. The pulp issuing from this circuit will now be taken to primary thickeners. These are 13x6-ft. Dorr machines, installed for the special purpose of giving a prompt thick product for concentration. In the concentrating plant, with the new addition, there will be 52 No. 3 Deister tables, upon which careful concentration of the slimes will be carried out.

The overflow from these primary thickeners is not expected to be clear, but will be of a more or less muddy consistency. This mixture is to be taken to a large Dorr thickener, which is used as a collector for the high-grade muddy solution. This machine is 30 ft. in diameter by 6 ft. deep. The lighter slime, which is naturally carried over to this thickener, contains comparatively little concentrates, in fact, so little that the problem of recovering them from the pulp may be considered as unimportant. The thickened slime is therefore sent to a sump from which it is pumped up for the agitation treatment.

IMPROVED TREATMENT OF CONCENTRATES

The concentrates obtained in the concentrating plant are treated intermittently in the same plant which was originally installed for that purpose. There is, however, a radical change in the treatment itself. The original system was to grind the concentrates in contact with mercury, amalgamating their values as far as possible. By the new process, the concentrates will be treated in the Wheeler pans and settlers by agitation with cyanide solution alone, no mercury being used and no recourse to amalgamation. This treatment of the concentrates has already been in use for a considerable time, the tailings from the treatment being added to a mill pulp and going through the agitation treatment along with the regular bulk of the mill product. Some study having been given to the matter, it has been decided that the additional recovery gained in passing the concentrates through the mill circuit is not sufficient to justify that course. In the future, these tailings will not be added to the mill circuit, but will be washed separately, in order to recover any solution and gold dissolved in solution, and then stored until some more satisfactory method of handling is arrived at. The concentrates, therefore, will be sent to a multiple-deck Dorr classifier. In this, by a series of washings, the valuable solution will be removed, and the tailings dewatered for storage.

The concentrate tailings obtained by this method contain approximately \$7 per ton. This is entirely too much

value to discard entirely, and it has been found economically impossible to recover any more through cyanide treatment upon the material in its condition. It is more than likely that a separate process involving roasting will be devised, whereby the major portion of this gold may be recovered. Experiments have shown rather clearly that a desulphurizing roast will place the gold in such condition that it may be easily obtained by cyanide treatment. For the present, however, the concentrates will be stored, and additional study will be put upon devising a method which will be satisfactory for recovering the gold in the concentrate tailings.

METHOD OF SLIMES TREATMENT

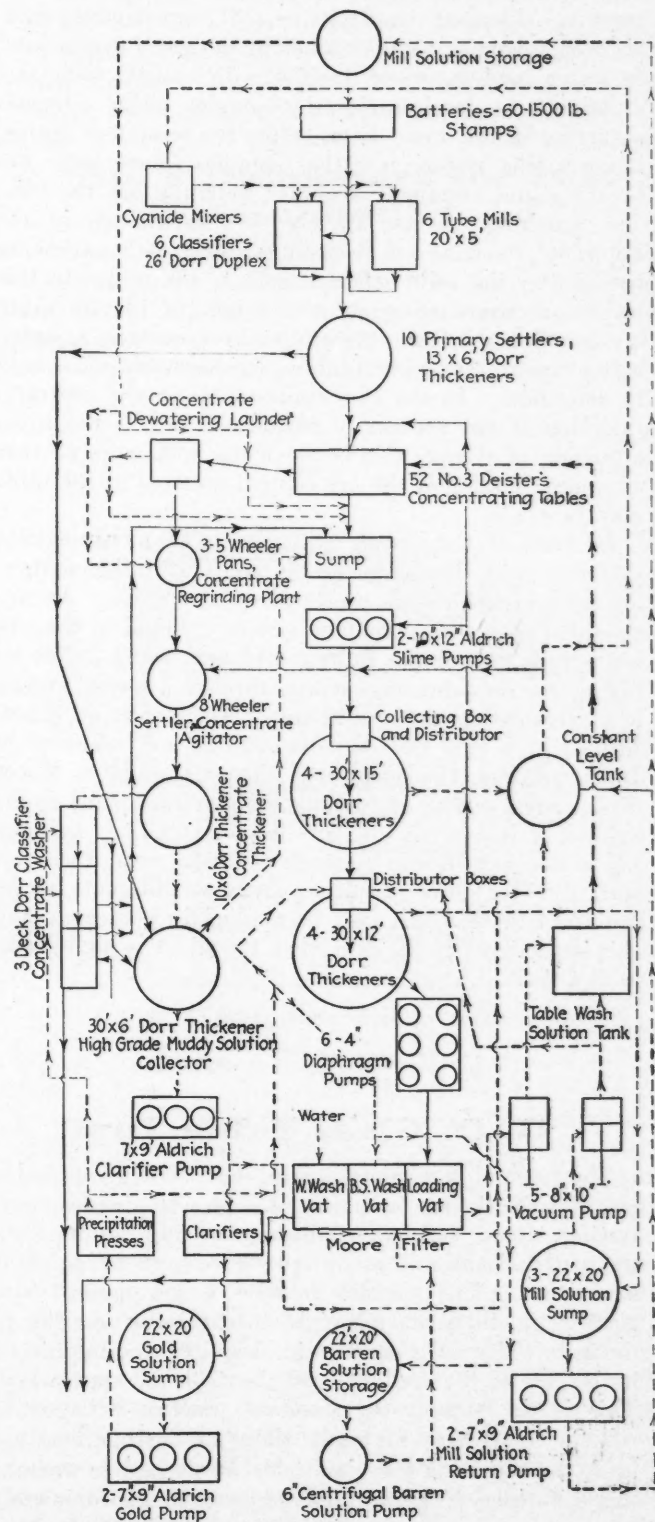
The treatment of the slimes pulp is by a modification of the counter-current decantation system. The first step is performed in four 30x15-ft. Dorr thickeners. The pulp issuing from these is taken to another set of four 30x12-ft. Dorr thickeners, among which it is distributed by a distributing box. It is diluted with treatment solution before entering these thickeners, whereby an additional dissolving of gold, with its consequent recovery, is obtained. From the second set of thickeners, the pulp is raised by diaphragm pumps and sent to the filtering system. The filter is the same Moore removable-leaf system which was installed in the original plant and which is now operated in the same way as formerly.

The accompanying flow sheet shows the method of progress of pulp and solutions through the mill. It will be noticed that the arrangement is such that solution pumping and pulp pumping or elevating is reduced to a minimum. If all solutions were sent from one end of the mill to the other, and had to be pumped back, the cost, involving extra solution precipitation, would be an item of importance. By reducing the amount of solution pumped, the amount precipitated is also reduced, and costs, both of pumping and of precipitation, are reduced to the lowest possible point.

The head value of the ore being treated in the Hollinger mill at the present time is about \$18 per ton. The concentrates extracted on the Deister tables average about \$55 per ton. The ore which gets past the concentrators and goes to the cyanide department averages about \$1.50 per ton, while the mill tailings from general treatment average about 15c. per ton.

It is to be noted that the overflow from the large Dorr thickener, which receives the muddy overflow of the preliminary settler, is pumped through clarifying presses and is then taken to the precipitation system. Or this solution may be diverted back to the concentrate-treatment department or to the original battery crushing department. The whole solution flow in this mill has been admirably designed to meet all contingencies. Under normal circumstances, however, a system of floats attached to valves has been so devised that it is almost never necessary for operators to manipulate the valves at all. Constant levels are maintained as required, and the different solution levels automatically arrange for their transportation to the proper department, as they are required. As now arranged, it is only in the extraordinary case, when some emergency arises, or when some unforeseen difficulty makes its appearance, that the operator on shift has anything to do with solution valves in the main treatment. Naturally, in such department as the filter, the op-

erator is required to make the few necessary changes for filtering, washing, etc. Taking it all in all, the Hollinger mill is a fine one, admirably adapted for the ore it has to treat, and arranged in an extremely convenient way. It is, perhaps, one of the best large-scale mills in operation, in that so little care and attention are necessary. The new stamp installation is not altogether complete, but within a short time it will be operated as is shown in the flow sheet.



FLOW SHEET OF HOLLINGER MILL

PORCUPINE PRACTICE AS DISTINGUISHED FROM THAT OF COBALT

An interesting circumstance is noticeable in the comparison of the mills of the Porcupine district with those of the silver-treating mills of Cobalt and adjacent territory. While in Porcupine, with its gold metallurgy, all efforts have been put forth toward devising automatic systems with their low costs and small supervision requirements, in the silver camp, efforts have been made, on the contrary, toward mechanical and metallurgical refinement directed toward securing the ultimate limit of high extraction. Thus, at the Nipissing mill, an extremely complicated system is installed, whereby the ore is first ground in water, and in water treated with caustic soda and aluminum to desulphurize the complex silver minerals occurring in the ores. Even before the treatment begins, however, the system is rather complex, since stage ore breaking and extremely accurate weighing are the rule. The weighing, as has already been mentioned in the JOURNAL², is done on recording scales, each car being passed over the scale before it goes to the mill. In this way an accurate record of the weight of the incoming ore is obtained. Since the ore is also accurately sampled before reaching cyanide solution, its exact content is easy to determine. In the Porcupine mills, on the contrary, sampling is not accurately performed, nor is weighing, although, of course, checks are made both ways so that an approximation of the ore content received at the mills may be made.

In most of the Cobalt mills, which use cyanidation, agitation is by the charge system and not by the continuous methods which are preferred at Porcupine. An approximation of the Porcupine system is found in the new high-grade mill of the Buffalo company, which treats its high-grade ores and concentrates through a special system of amalgamation and cyanidation. Amalgamation is performed in a tube mill and the tailings are cyanided in Dorr agitators, thickened and filtered through a Moore filter system. The one unique step in this plant is the method of recovering mercury from the tailings by passing a mercury solvent through the cake upon the filter leaf. Silver ores require entirely different methods from those which may be applied to gold ores, and this is particularly the case when the silver is high grade, as at Cobalt.

(To be concluded)

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G.-O. Glass Table Top*

The General Ore Concentrating Co., Inc., of 40 Cedar St., New York, has brought out a glass top for concentrating tables, which has given promising results in a test at the Miami mill and at another concentrating plant in Arizona. The table top consists of one piece of wire glass $\frac{3}{8}$ in. thick, having eight corrugations or ruffles to the inch. The ruffles are 0.06 in. deep, but are diminished in height as the feed end of the table is approached. This is the opposite of standard practice with coarse riffing, but where so many ruffles or corrugations are used, the action on the glass table top is said to warrant this difference. The tailings discharge at approximately

*From data furnished by the manufacturers.

the same speed as the wash water from the table, while the concentrates being moved only by the reciprocating motion of the table, accumulate, so that it is necessary to provide on the advanced section of the table a greater protective area than at the feed end, where the ratio of the concentrates to tailings is equivalent to that of the original ore.

A section of the table top directly under the feed box is made either from linoleum, concrete or rubber, and is so arranged as to be horizontal when the table is at its normal operating pitch. This causes stratification before decantation and is designed to assist in the precipitation of the heavier minerals.

The distribution of the concentrates on the G-O table top differs greatly from that on the ordinary table. The concentrates leave the ordinary table in greatest abundance close to the tailings. On the G-O top, the distribution of the products at the end of the table is reversed, the greatest amount of concentrates coming off high on the table, leaving a section several feet wide between the main body of concentrates and the tailings where only lean middlings pass over, so that in case of fluctuations of feed there is a considerable margin before the main body of the concentrates is in danger of passing out the tailings launder. This is an important factor in the ordinary operation of a mill, and especially on night shifts, where tables are likely to receive less attention than normally. With the G-O table tops, there is almost no free mineral mixed with the middlings; hence in case of subsequent regrinding, they produce less slimes and tend toward greater recovery. Superior results were obtained in this respect both at the Miami mill and at the tests at the Consolidated Arizona Smelting Co.'s mill at Humboldt, where some preliminary work was done in competition with the flotation method with favorable results, particularly in the elimination of silica and the saving of iron, these minerals not being so favorably handled by the flotation method. Thus, more favorable smelting charges may be obtained on account of the superior fluxing value of the table concentrates.

The wire-glass table top is not so delicate as might be expected. The manufacturers state that a sheet of glass 10 ft. long will stand a deflection of 8 in. Once attached to the table, the possibility of breakage is practically eliminated, but even if the top should be cracked, the wire insertion prevents the scattering of the pieces, and such a table may be operated for months. The glass top is provided with a felt cushion which obviates the effect of the warping of the wooden surface underneath. The top may be laid on any ordinary wooden deck by applying a damp-resisting cement; the glass, with the felt already attached, is then laid on the table, the corners fastened and the two small steel plates attached. The table is then ready for operation. The wearing qualities of the glass as applied under the circumstances existing in concentrating practice is satisfactory; as the sand travels with much less speed than it does in launders, the wear is much reduced. The glass has the advantage of being noncorrosive and nonporous. It is natural that a surface which lasts longest unimpaired will give the greatest average extraction; the polished surface in the bottom of the grooves of the glass top remains intact on account of the fact that the concentrates which travel therein are soft. The G-O glass table tops can be attached to any of the standard concentrating tables.

Details of Practical Mining

Ore-Chute Side Pocket

By Lewis B. Pringle*

The accompanying illustration shows an ore chute used by the Cananea Consolidated Copper Co., in its Capote mine. The chute was designed by the geological department of the company, and was first used in getting the silica ore from the "silica stope." The chute in itself need not differ from any of the many chutes now used. The feature newly introduced is an elevated pocket on one side of the chute, reached by a short ladder.

Ordinarily, if a chute becomes jammed, the jam must be broken by one of two methods; i.e., either by discharging a piece of dynamite in the chute, or by breaking the jam with a crowbar or "prod." The first method is frequently objectionable because of the danger of injuring the chute, and because of the resulting fumes. When

elbow shown was cut off, and the back stulls were lengthened a foot or more. The few dimensions given are more or less standard.

The planking which keeps the rock from filling into the pocket, can be raised or lowered as necessary, leaving enough room between the top plank and the roof for a man to work over. The board that controls the flow of the ore is also raised or lowered as required.

No. 8 Detonators for Fast Tunneling

On the development tunnel of a Western gold mine, according to the *du Pont Magazine* for July, 1914, blasting had been done with 40% gelatin and No. 6 caps. The superintendent, thinking he might obtain more perfect detonation thereby, substituted No. 8 caps for the

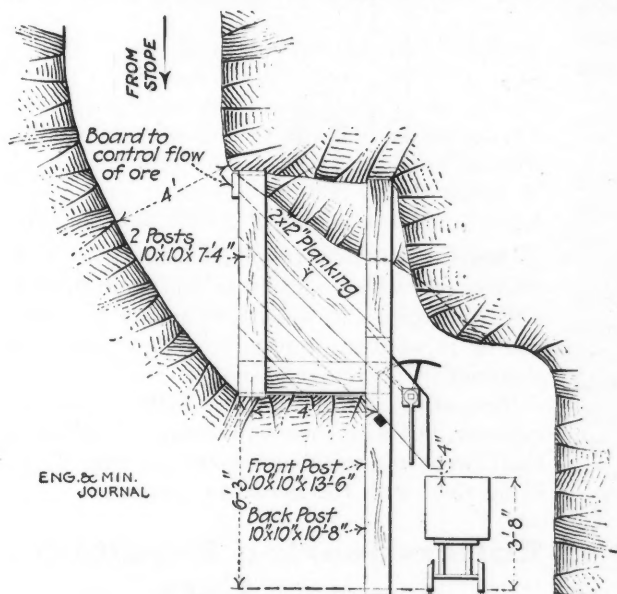


FIG. 1. SIDE ELEVATION AND SECTION

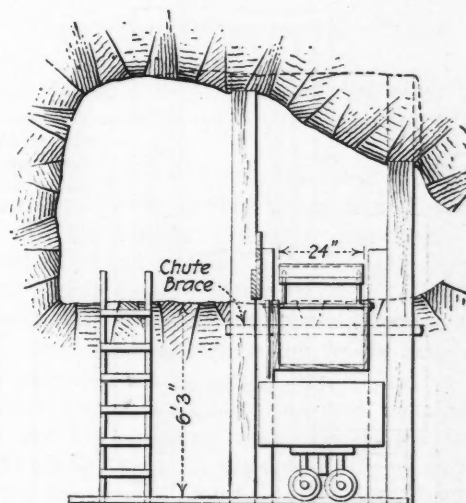


FIG. 2. FRONT ELEVATION

the latter method is preferable, the arrangement herein described will prove to be a time-saver and a help to the man who is using the crowbar.

The car-filler generally has either to reach over the partly filled car, or get upon it, and poke his bar up through the chute gate. The arrangement herein described permits the car-filler to climb into the adjoining pocket, reach over the planking shown in Fig. 1 and get at the seat of the trouble more easily and more quickly than otherwise. Often the rock jams at the elbow of the chute, and the pocket herein described enables a man to reach this elbow, as he could not, working from below.

The erected chutes do not follow the drawing in detail; the latter merely illustrates the idea and the chute builder constructs the chute to meet the required conditions. In building the first chute of this type, the sharp

No. 6 and increased his progress from 4 to 5 in. per shift. This, of course, more than accounts for the increased price of the caps. The magazine notes that in many tunneling operations there is no other way of increasing the footage broken per round. It is impossible to increase the number of holes, and a more powerful explosive may be unsuitable for the rock. Increasing the quantity of explosive in each hole would cut down the tamping and result in blown-out shots. It is probably not possible to develop the entire potential strength of any high explosive; decomposition is always theoretically incomplete, but the more nearly complete it is, the more work is done and the less noxious are the fumes produced. Practically complete decomposition of an explosive and production of a maximum disruptive effect can be had only by using tamping and the largest and strongest detonator practicable.

Where blasting is of such a character that the drill

*Quincy, Ill., formerly geologist for the Cananea Con. Copper Co., Son., Mex.

holes are overloaded, that is, when more explosive is put in or stronger explosive is used than that actually necessary to break the rock, it is unlikely the substitution of a stronger detonator will be noticed; but where overloading the drill holes produces less effect, as in tunneling where a definite amount of tamping is absolutely required to prevent the charges from blowing out, supposing the rock to be hard and tough, and where accurate measurements are possible, it will be found that in practically every instance a No. 8 detonator will result in faster progress than a No. 6.

[This insistence of the du Pont experts on the use of tamping in tunneling is interesting, in view of the opinion set forth by Messrs. Gray and Brunton in Bulletin 57, published by the U. S. Bureau of Mines on the subject of tunneling, to the effect, namely, that tamping in most tunneling does not pay.—EDITOR.]

Converting Steam Hoists to Electric

The introduction of electric power at the mines of the Penn Iron Mining Co. in Michigan necessitated changing over to motor drive the steam driven hoists in use (*Bull. A. I. M. E.*, February, 1914). Two geared hoists with tandem drums shown in Fig. 1 were converted by extending the pinion shaft, which lies between the drums, some

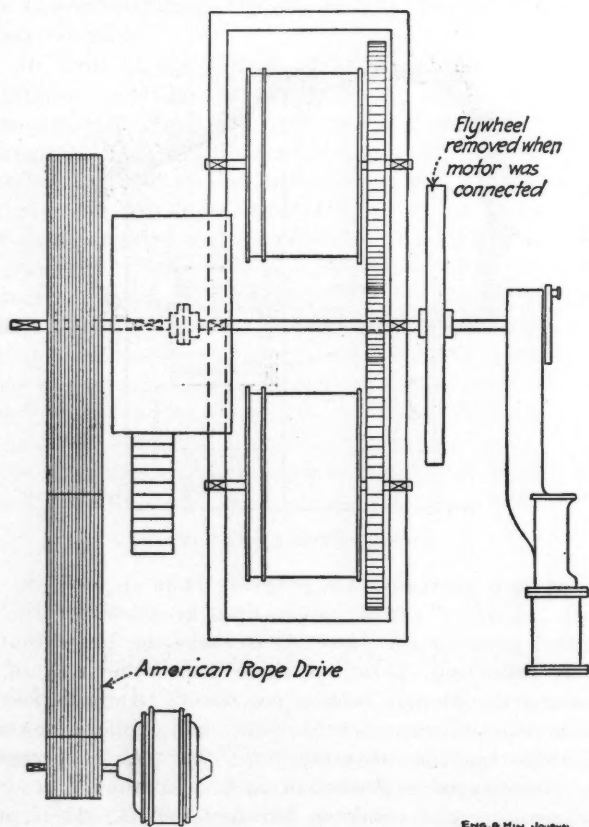


FIG. 1. METHOD OF CONNECTING TANDEM-DRUM HOISTS

distance on the side opposite the steam cylinder and putting on the extension a large rope wheel for an American system rope drive from the shaft of a reduction motor. The connecting-rod of the steam engine was disconnected. In one case the motor is rated at 200 hp. and hoists a skip load of 6700 lb., the speed of the cage and the skip being 590 ft. per min. and the maximum distance of

travel for the skip, 1557 ft. The motor at the other shaft is rated at 350 hp., and handles a skip load of 6000 lb., the skip and cage speed being 558 ft. per min., the maximum distance of skip travel being 1546 ft. This motor

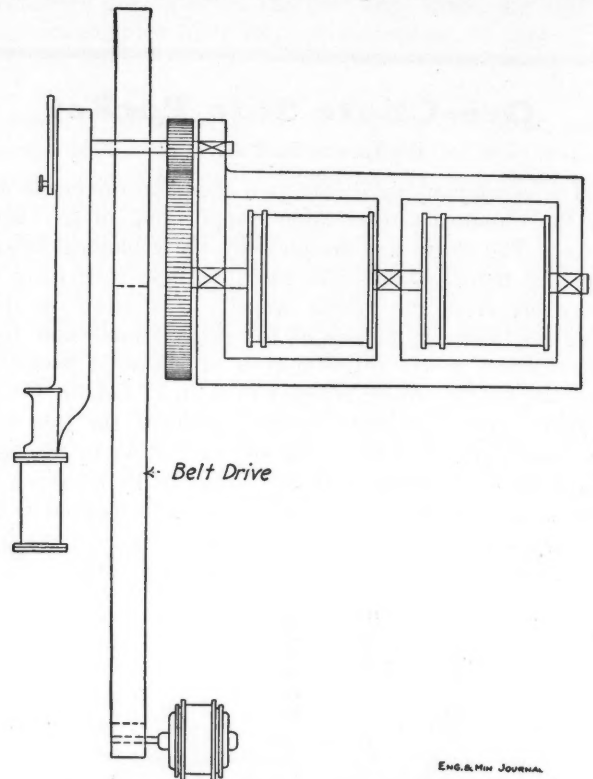


FIG. 2. DRUMS ON THE SAME SHAFT

is larger than necessary. In operation the motor rope wheels, gear wheels and drum shafts are started first when a trip is begun and when they are up to speed, the drum clutch is applied gradually and a quick acceleration obtained.

Two other hoists similarly driven by a single steam cylinder, but with their two drums set side by side on the shaft were converted as shown in Fig. 2, a belt drive being used with the motor in this case.

Roller-Bearing Results on Mine Cars

Interesting figures on the saving to be effected by using roller bearings instead of ordinary bearings for cars are furnished by the Sanford-Day Iron Works, of Knoxville, Tenn., who make the Whitney roller bearing. The figures are given in the accompanying table; they are the result of a test conducted by the engineer of a large company which has in use about 550 sets of the "Whitney Wonder" roller-bearing trucks. The test was not conducted by the manufacturers, but by the company, for the sake of finding out the relative advantages of the two types of bearings.

Three trips were made with each type of bearing, each consisting of 20 cars loaded with 3.1 tons each, hauled 3250 ft. and back. Ammeter and voltmeter readings were taken as often as possible, about 18 times each way, and these were checked with wattmeter readings. The trips were made over the same track, for the same distance, by the same motorman, and the same locomotive, and the best possible time was attempted in each case. The slow time of the first trip with the solid hub is due to

the fact that the preceding trips with the roller bearings had been made on an unsanded track and it was found that the sanding was necessary for the ordinary type of bearing.

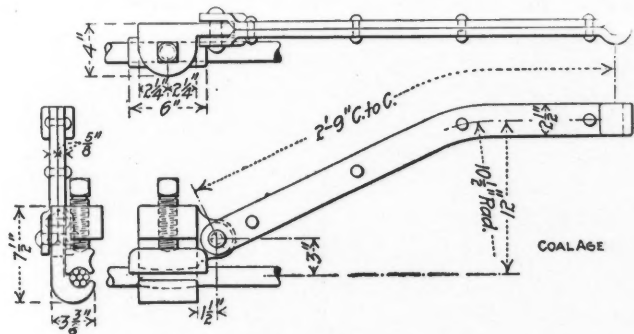
The saving was 58% in power and 50% in time. Furthermore, a long life and little care are claimed for the roller bearings. Figures are lacking on the size of wheel, gage of track, weight of locomotive, etc. But it is stated by the company that the additional cost for the roller bearings over the common type of solid hub is between \$6 and \$7. We assume that this is per pair of wheels. Thus, where a solid-hub truck would cost about \$18, a roller-bearing truck would cost between \$25 and \$26.

TEST OF POWER REQUIRED FOR HAULAGE WITH SOLID HUB AND WITH ROLLER BEARINGS

Trips	Solid Hub				Roller Bearing			
	No. 1	No. 2	No. 3	Average	No. 1	No. 2	No. 3	Average
	Min.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
Time of round trips...	23.5	10.25	11.0	14.9	8.66	7.16	6.66	7.5
Average amperes....	185	169	180	178	155	156	152	154
Average volts.....	478	472	460	470	460	469	467	465
Kilowatts.....	88.4	80.0	82.9	83.78	71.3	73.16	71.0	71.81
Kilowatt-hr.....	34.6	13.7	15.2	21.0	10.6	8.75	7.9	8.8

Endless-Rope Gravity Inclined Plane*

The Gem mine lowers its coal from the mine entrance to the tippie on the railroad, a vertical distance of 613 ft. The horizontal distance covered is 3640 ft., the length of the plane is 3700 ft. and its average inclination is 16.8%. The plane starts with 19.8% grade; this runs for 750 ft., increases to 28.4% for 600 ft., decreases to 18.8% for 300 ft., and then gradually decreases until it end with a 3.3% grade. Two 36-in.-gage tracks are laid on 6-ft. centers with 30-lb. rails. Cast-iron rollers, 6 in. in diameter and 6 in. wide, with chilled surfaces, are placed



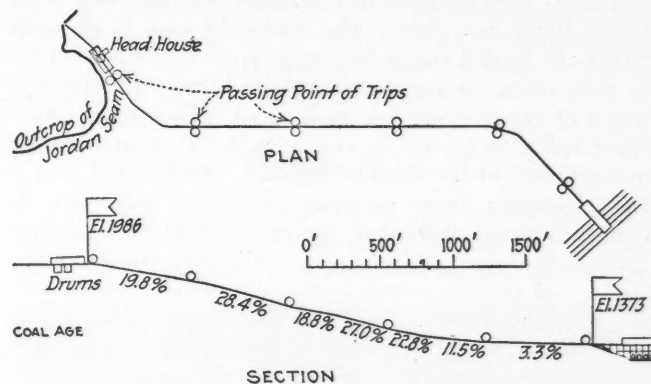
DETAILS OF THE GRIP

in the center of each track on 50-ft. centers. The ties are placed on 20-in. centers; a 10-in. board spiked to these keeps the rope from dragging on the ground. There are two curves, one near the top which is on an inclination of 20%, the other near the bottom on a 3% grade. On the curves the outer rail is elevated and sheaves are placed 20 ft. apart to deflect the rope.

The rope is of plow steel, 1 1/8 in. in diameter and composed of six strands of 19 wires each wrapped around a hemp center. The rope runs around a sheave wheel placed on a tension carriage underneath the tippie floor and four times around the drums, which are beneath the floor of the head house.

*An abstract of a paper read before the West Virginia Coal Mining Institute, June 3, 1914, and published in "Coal Age," Aug. 1, 1914

The tension carriage is made from a standard freight-car truck. Upon this is mounted an iron sheave, 6 ft. in diameter with a 4 1/8-in. shaft. This truck rolls on 30-lb. rails set on an angle of 35° to the horizontal and is loaded with scrap until it weighs three tons. Its distance of travel scarcely exceeds 3 in. The two cast-iron drums at the head of the plane are 6 ft. in diameter and 4 ft. high, set vertically on 10-ft. centers with their line of centers parallel to the plane and grooved to receive the rope. These drums are controlled by an ordinary friction-band brake, suitably counter-weighted so that the brake is set, except when held released by the drum man. This brake is connected by a 1/2-in. chain to a handwheel, such as is used on freight cars. This wheel



PLAN AND PROFILE OF THE PLANE

is on one side, out of the way of the cars, but close enough for the operator to see the headmen attach and detach the trains.

The cars are pushed into the head house by the mine motor and made up into trains of five cars coupled together by the regular mine-car couplings. To the rear drawbar of the last car a special grip is attached. While the loaded train is being attached to the rope, an empty train has been detached on the adjacent track; at the same time the couplers in the tippie have detached a loaded and attached an empty trip.

The drum man gets signals from both the tippie couplers and the top couplers, then releases his brake and allows the loaded train to descend, until an empty train ascends to the proper point in the head house. The distance traveled in one interval is about 700 ft.; in operation five loaded trips are on the rope.

There is surprisingly little difference in the spacing of the trains and it is seldom they have to be respaced. There is no difficulty in increasing the number or size of trains, but the rope distance between the attaching and detaching points must be the same, and this distance will govern the spacing. In this particular installation there are six loaded trains and six empty on the plane at one time, counting those at the head and at the tippie.

The grip arm is made from machine steel, 2 1/2 x 5/8 in., doubled back and riveted by 5/8-in. rivets. The upper end is rounded out to receive the 1 1/8-in. clevis pin of the car coupling; the lower end is flared out in the form of a yoke to receive the head. The arm is bent vertically to compensate for the difference in height of the drawbar and rope. The head setscrew is 1 1/2 x 4 1/2 in. The grip block is made from a piece of steel, 2 x 2 1/4 x 6 in., forged as shown and drilled to receive the point of the setscrew.

The bottom and outside are grooved, the bottom to receive the rope and the side to clear the flange of the curve sheaves. The jaw is forged from a piece of steel, 4x4 1/4 x 6 in., recessed as shown to receive the rope and drilled and threaded for the setscrew. Both the grip block and the jaw are turned in the form of an arc, so that when the setscrew is tightened the rope is crimped, thereby preventing any slippage. The crimping being only 1/8 in. does not injure the rope. The grips weigh about 50 lb. each and their maintenance is almost negligible. To attach or detach one takes considerably less than a minute.

Seven men are required to operate the plane. The drum man operates the drum and has supervision over the head. Two couplers in the head house and two on the tippie attach and detach the trains. A man is stationed where the loaded trains first stop, and at this point there is a derailing switch which can be thrown in case of a wreck or runaway on the track above. This plane man is furnished with a wrench, and tests the grips and oils the outer wheels of the descending cars. At the first stop of the ascending train an oiler is placed who oils the outer wheels of the ascending cars. Both of these men command a view of the upper and lower curves respectively, and at each station is placed a switch, which, when thrown, flashes an electric light in the head house; thus, in case of a wreck or accident, warning the drum man, who immediately stops the rope.

Two years ago the present rope was installed and cost in place \$2000. A new rope, recently ordered for installation during the summer, will cost much less. In 1913, 140,497 tons was lowered in 268 days of nine hours each, or an average of 524 tons per day. The maximum handled in one day was 885 tons in 8 1/2 hr., or 104 tons per hour.

Taking the life of the rope at two years, which has been proved by past experience to be the average, the depreciation of the rope amounts to 0.7c. for each ton of coal handled. The wages of the seven men employed aggregate \$11.83 per day, or 2.25c. per ton; this also includes the labor of oiling the mine cars. The cost of maintenance and renewal of ties, rollers, sheaves, grips, etc., averaged over a period of months is approximately \$25 per month, or 0.2c. per ton of coal handled. This includes cleaning up wrecks, replacing derailed cars, etc. There is an average of one wreck per month, which takes two hours to clean up. Most of the wrecks occur on the curves. The total cost of running and maintaining the plane per ton of coal handled, is therefore, 3.15c.

The tension on the rope can be calculated in a simple manner by assuming it to be stationary and composed of two independent ropes suspended at the top of the drums. Then the point of maximum strain will occur where the rope supporting the loaded cars first comes in contact with the drums and the strain at this point will be the greatest just as the loaded train goes on the slope and the rope is supporting 25 loaded mine cars plus the length of one rope from the drum to the tension carriage plus half the pull of the tension carriage. The

other rope will be sustaining the same weight less the actual weight of the coal in the cars. The empty cars weigh 1200 lb. and the loaded 4000 lb., so that the total movable weight on the loaded side that the drum supports is:

	Lb.
25 loaded cars @ 4000 lb.	100,000
1/2 weight of 6000-lb. tension carriage	3,000
4000 ft. of rope @ 2 lb.	8,000
Total	111,000

The average inclination of the trains at the time when the tension on the drum is greatest is 18.8%, or 10° 39'. The tension *T* on the rope due to the loaded trip is:

$$T = W (\sin a - \cos a \times Z) \text{ where}$$

W is the weight of the loaded trip, 100,000 lb.
a is the angle of the plane, 10° 39'.
Z is the coefficient of friction equal to 1/20.

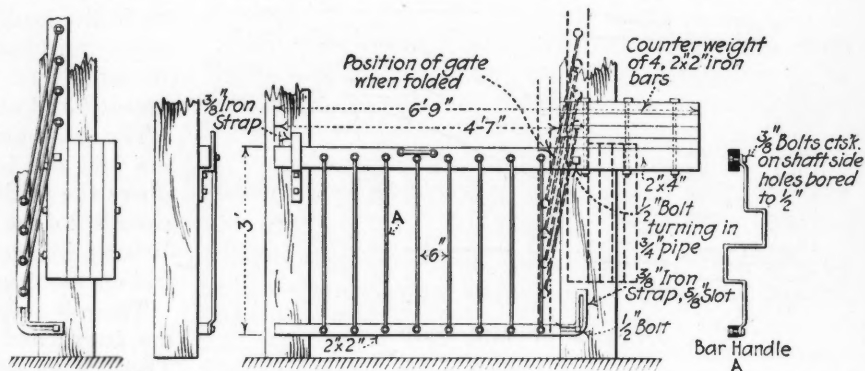
Substituting and solving for *T*, we find that the tension on the rope due to the loaded trip is 13,568 lb. Morin gives the coefficient of friction of metal on oak as 1/2. Using this coefficient and *W*, the weight of the rope as 8000 lb., in the formula, it can be shown that the dragging of the rope acts as a brake to the extent of 2453 lb. In the same way, it can be shown that the pull exerted by the tension carriage amounts to 1598 lb. The total tension on the loaded rope at its point of contact with the drum will be 13,568 plus 1598 minus 2453, or 12,713 lb., or 6.4 tons.

Folding Gate across Shaft

By W. H. JOBE*

The accompanying illustration, published in my report for 1912-1913, represents a shaft gate designed by Capt. Edward Jacka, of the Armenia mine, Crystal Falls, Mich.

It consists of two horizontal wooden bars, the top one 2x4 in., the lower 2x2 in. These are connected by eight



FOLDING GATE FOR SHAFT

vertical iron bars bolted loosely at the top and bottom. The upper horizontal bar pivots on a 1/2-in. bolt, turning in a 3/4-in. pipe in the shaft timber. The lower horizontal bar ends in an iron strap turned at right angles, 3/8 in. thick with a 5/8-in. slot along its middle. A 1/2-in. bolt through the slot holds the strap to the shaft timbers, but permits it to slide. Thus, as the gate is raised, it folds up as shown.

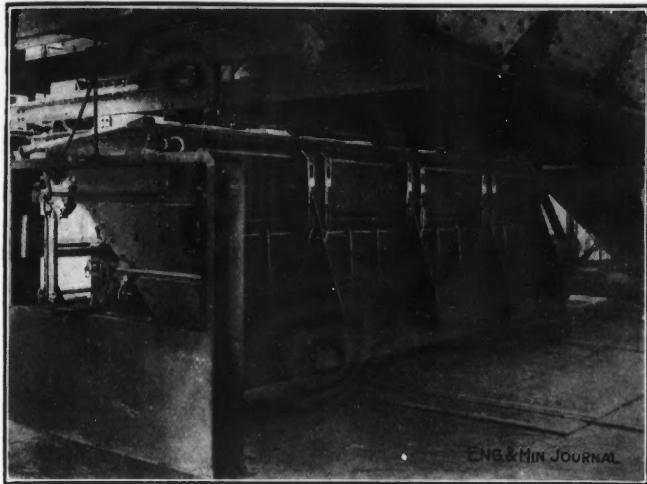
A counterweight of four 2x2-in. iron bars is bolted to the upper horizontal bar. One of the vertical bars has two offsets as shown, and serves as a handle.

*Inspector of mines for Iron County, Crystal Falls, Mich.

Details of Milling and Smelting

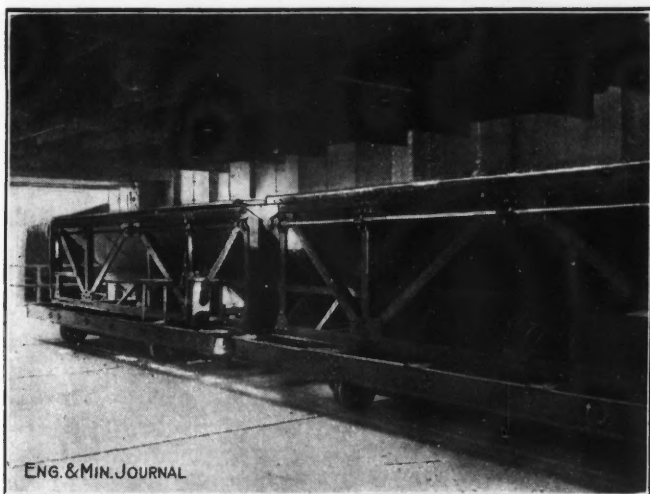
C. & A. Charge Car

The blast-furnace charging arrangements at the new Calumet & Arizona smelting works at Douglas, Ariz., are interesting. The accompanying illustrations of the



C. & A. CHARGE CARS, STOCK BINS AND SCALE

C. & A. charge cars will also give some idea of the general charging arrangement. The blast furnaces are 40 ft. long, and on each side of a furnace are two charge cars that never leave the charge floor, merely running between the stock bins and furnace doors, the two



CHARGE CARS MOVED FORWARD TO FURNACE DOORS

positions being illustrated in the accompanying engravings. The furnace charge is delivered by belt conveyors into stock bins on each side of the furnaces; there are also bins for coke, which is loaded on the top of the charge.

The charge cars are of the gable-bottom type, and are propelled by their own motor. The tops of the cars are close to the hoppers of the stock bins, so that little material is spilled on the floor. The gates of the bins are

operated by compressed air, and after the charge is dropped into the car and weighed by the platform scales, shown at the left of one of the engravings, the car is propelled to the furnace doors, as shown in the other illustration. There are but two doors on the side of the furnace, and each car corresponds to the length of a door. This arrangement enables these large furnaces to be fed with a minimum of confusion on the furnace feed floor, and eliminates many of the undesirable features that exist when charge trains are run through a furnace building.

✽

Globe Tube-Mill Lining

Tube-mill linings of the Globe type are in use at several mills in Ontario. This lining is based on the same principle as the well known El Oro lining, that is, deep



INTERIOR OF TUBE MILL WITH GLOBE LINING

iron plates having channels into which pebbles wedge themselves, forming a lining which prevents wear of the iron. The difference is that in the El Oro type the channels run longitudinally from one end of the mill to the other, while in the Globe design, the channels run around the mill. The taper is arranged so that the turning of the mill wedges the pebbles more and more firmly into their places. The accompanying illustration shows the appearance of the interior of a mill so lined.

Tube mills equipped with this lining have been in use

for some time at the Hollinger plant, Timmins, Ont., where they are said to be giving about three months' service more than the El Oro lining. The Cobalt Lake mill, at Cobalt, Ont., uses it with satisfactory results, and one mill is being equipped with it at the Dome mill, South Porcupine, for test. The type was designed by A. R. Globe, assistant general manager of the Hollinger Gold Mines, Ltd.

✻

Electric Annealing Furnace*

An electric heating furnace for annealing brass and german-silver flat-ware blanks has just been installed by a Niagara Falls maker of plated table ware.

The furnace framework is made of steel shapes and plates, and is 15 ft. long, 8 ft. wide, 7 ft. 6 in. high. The doors are situated at both ends of the furnace.

A mechanical pusher operated by compressed-air cylinders running over cast-iron idler sheaves operates the

or cooling, as the furnace itself has a reducing atmosphere at all times.

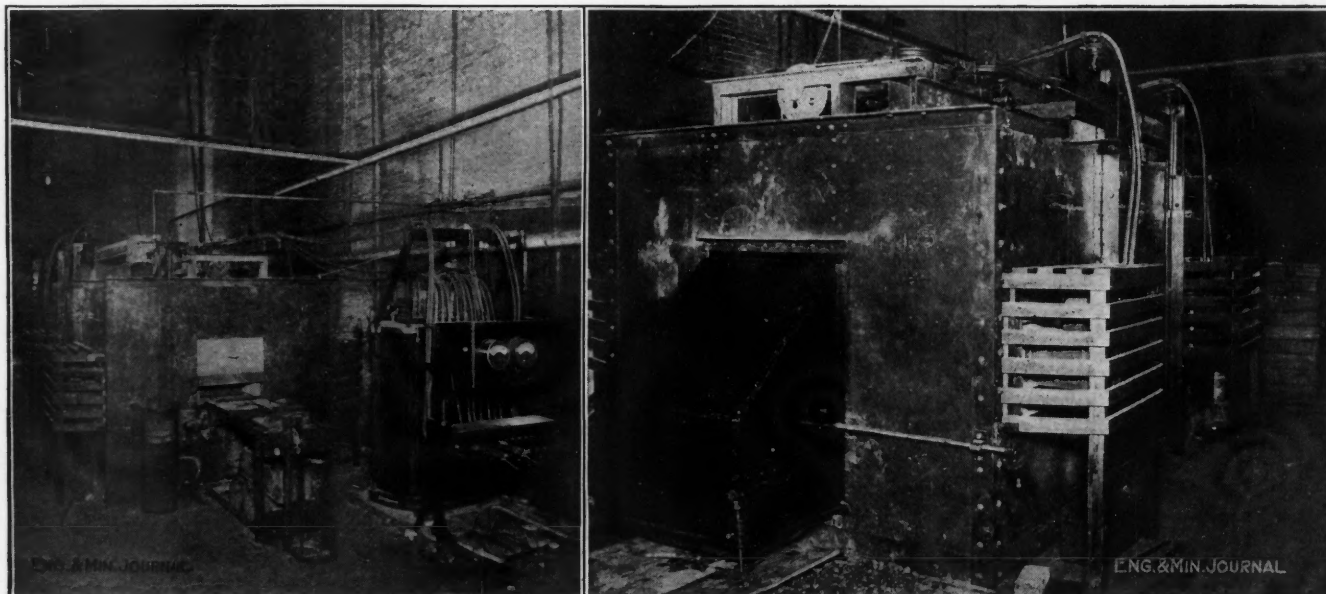
The operation of this furnace has demonstrated clearly the superiority of continuous electric furnaces for the class of work handled, as the desired temperature may be reached with the utmost precision and without danger of overheating.

This furnace was designed and installed by the Electric Furnace Co. of America, Alliance, Ohio, which has recently received a duplicate order from the same plant.

✻

Sand Separation at the Dome Mill

As newly arranged, the Dome mill, South Porcupine, Ont., will treat sands and slimes separately. The batteries will probably be equipped with 3- or 4-mesh screens. Pulp from them will go to a 4x16-ft. duplex Dorr classifier, which delivers the oversize to a 5x22-ft. tube mill, and the slimes to the foot of an elevator. There is but



ELECTRIC ANNEALING FURNACE

Charging end

Water-sealed discharge

pusher mechanism situated at the charging end of the furnace. The material under treatment is packed in steel pans 20 in. square, which were forced through one after another, seven pans being in the furnace at one time. The pans passing through the furnace are supported by a hearth made of cast-iron grids 24 in. square, and are of a design which prevents undue warping at furnace temperatures. The pan coming out of the discharge end of the furnace is automatically dumped into a water-sealed discharge hood. The metal falls into a tank of either clear water or pickling solution, depending upon the cleanliness of the material before it is charged into the furnace. The pan itself is caught by two rails and held suspended above the trough and may be taken out from under the water-sealed hood through the counterbalanced swing door shown in Fig. 2.

The material is not exposed to the atmosphere at any time after entrance to the furnace until it is taken from the quenching tank cold. This entirely eliminates any possibility of oxidation at any stage during the heating

one passage of material through the tube mill, none of the product being returned. The tube-mill discharge joins the slimes going to the elevator.

From the elevator, the pulp is led over a series of amalgamating plates, twenty-four 54x144-in. plates being installed. Crushing is in water, and an extraction of between 70 and 80% is secured by amalgamation.

From the plates the pump passes to a battery of Merrill hydraulic cones, the slimes from these going to the thickening and agitation tanks, and treated exactly as the system was before the change. Sand from the classifiers goes to a battery of Merrill concentrating cones, two to each classifying cone. Sands from these overflow to the sand-treatment tanks, and the concentrates pass over amalgamating plates, and thence to the Dorr classifier, where they are taken out with the sands and go into the tube mills for further grinding. By this system the concentrates circulate between the tube mills and amalgamating plates until they have been ground fine enough to pass out into one of the treatment systems, in either case fine enough to give up their metal content to the cyanide solutions.

*From data furnished by the manufacturers.

The Assayer and Chemist

Determination of Thorium in Monazite Sand*

The method depends upon the complete precipitation of thorium pyrophosphate by means of sodium pyrophosphate in acid solution. The pyrophosphates of cerous cerium and of the other rare earth metals with the exception of zirconium are soluble in acid and remain in solution. The sand is first decomposed with concentrated sulphuric acid and an aliquot portion of the diluted and filtered solution, representing about 2.5 grams of the mineral, is diluted to 450 c.c., acidified with 5 c.c. of hydrochloric acid and 15 c.c. of 5% solution of sodium pyrophosphate added. After boiling, the precipitate of thorium and zirconium pyrophosphates (containing also traces of ceric and other pyrophosphates mechanically brought down) is filtered off and converted into sulphate by digestion on the filter paper in a Kjeldahl flask with 15 c.c. of concentrated sulphuric acid and a few crystals of ammonium perchlorate. After cooling the clear solution is diluted and the hydroxides are precipitated with sodium hydroxide. These are then after filtration dissolved in hydrochloric acid, a few cubic centimeters of concentrated sulphur-dioxide solution added to reduce any ceric cerium, and the phosphate precipitation and subsequent conversion into sulphate and hydroxide repeated. The hydroxides of thorium and zirconium are dissolved in hydrochloric acid and the thorium precipitated from this solution as oxalate by the addition of 2 grams of oxalic acid. The solution is diluted to 450 c.c. and allowed to stand over night. The pure thorium oxalate is then filtered off, and ignited and weighed as oxide. The oxide obtained was always quite white, and free from phosphate and from cerium. The results of analyses, both of mixtures of thoria with pure rare earth salts, and of various samples of monazite demonstrated the reliability of the method, and they were in close agreement with those obtained by the iodate method of Mayer and Speter.

Determination of Sulphates by Barium Precipitation

The difficulties of obtaining a pure barium-sulphate precipitate in the presence of other salts is well known. A method is proposed by W. A. Turner (*Am. Journ. Sci.*, July, 1914) to get rid of sodium and to a lesser degree, potassium, before the sulphate precipitation. The sample, representing a quantity of sulphur which will give about one gram of barium sulphate, is dissolved (after fusion with sodium carbonate and peroxide, if necessary), in the least convenient quantity of water.

It is then treated with five volumes of concentrated hydrochloric acid, and the resulting precipitate of alkali chloride is filtered off on asbestos under suction. Wash the precipitate clean with concentrated hydrochloric acid. Evaporate the combined filtrate and washings on the

steam bath, take up the residue with a little water and 1 cc. of 4% hydrochloric acid, and filter through a small filter. Dilute to 350 c.c., heat to boiling and add 10% BaCl₂ solution drop by drop to 1 to 2 c.c. excess. The precipitate is allowed to digest on the steam bath for several hours, over night if convenient, filtered on asbestos, ignited at low red heat and weighed. The method is especially recommended after alkaline fusions, substituting sodium peroxide for potassium nitrate.

A Laboratory Filter Press

BY BANCROFT GORE*

A miniature filter press for rapid testing work, designed for study of problems involving filtration of solutions, lake formation, leaching in solution, washing



FIG. 1. GENERAL VIEW OF FILTER PRESS WHEN OPEN

and air-drying, which is a valuable unit for a miniature ore-testing plant or works laboratory, was specially made for use by the department of metallurgy of the Montana State School of Mines. It forms one unit in a series of miniature testing apparatus where samples not exceeding 25 lb. can be put through the usual steps of fine grinding in acid or cyanide solutions, air agitation, filtration, washing and precipitation of pregnant solutions.

In selecting a press for class work and general testing purposes, the importance of being able to use it for a large variety of work under varying conditions, was a governing factor. Furthermore, it was essential that a number of tests could be made rapidly in a three-hour period without undue loss of time resulting from cleaning up and preparing the press and accessories for each cycle

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*Butte, Mont.

of operations. The type selected was supplied by the Kelly Filter Press Co., of Salt Lake City, and is shown in Fig. 1, where it is set up for filtration and washing of slimes resulting from the agitation of oxidized copper ores in sulphuric-acid solution. Its dimensions are as follows: *A*, montejus, 10-in. wrought-iron pipe, lead lined; *B*, pressure tank, 15x7-in. diameter outside, length overall when discharging cake, 35 in.; *C*, slime-inlet pipe from montejus, 3/4-in. diameter; *D*, air-pressure line, 1/2-in. diameter; *E*, water-inlet pipe, 3/4-in. diameter. The leaves measure 4 1/4 x 13 in. and from one to four may be used. The capacity in dry slime is 25 pounds.

The leaves, one of which is shown in Fig. 2, coated with cake of slime 1 in. thick, are easily removable for changing filter cloths. The inner surfaces of all piping connections and of the pressure tank are coated with acid-resisting paint. The locking device on head of pressure tank is designed to facilitate opening and closing of the press giving an air-tight joint, thus making it possible to put through a number of tests in an afternoon, using variations in pressure, thickness of cake formed, density, and temperature of pulp treated, amount of wash water, etc. Cakes ranging in thickness from 1/8 to 1 1/4 in. have

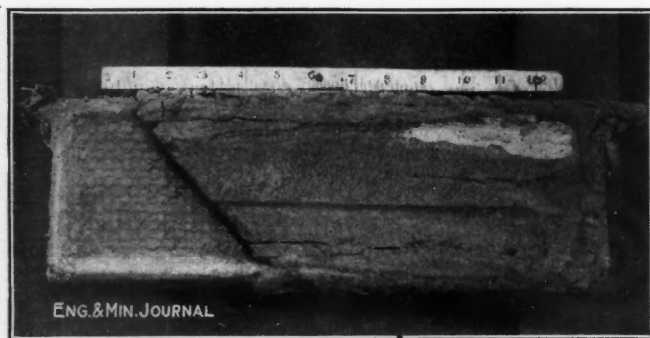


FIG. 2. LEAF FROM LABORATORY FILTER PRESS, SHOWING CAKE 1 IN. THICK

been made in this press. A study of a wide variety of filter mediums is possible, owing to the ease with which the filter frames can be removed from the tank, stripped of their filter cloths and different material substituted.

Fabrics tested at the school include asbestos, different weights and qualities on canvas, woolen cloths for acid work, burlaps, fiber-cloth, sheetings and byproduct paper pulp.

Another application of the press is in connection with the zinc and aluminum-dust precipitation of pregnant solutions from cyanide work. The pulp is first filtered and washed in the press and the clear filtrate after agitation with the dust is returned to the montejus and forced into the pressure cylinder, containing one leaf covered with heavy filter paper.

Zirconium Dioxide Crucibles

Crucibles prepared from zirconium dioxide (mixed preferably with 1% of dry starch and 3% of magnesia), and fired first at 1450° C. and then at 2200° C., were found to be almost impervious and to resist a temperature of over 2200° C. in the vacuum electric furnace. They were successfully employed in determining the boiling point of pure iron, etc., and for fusing tungsten alloys, according to Ruff, Leiferheld and Bruschke, *Zeit. anorg. Chem.*, p. 389, 1914.

Assaying Cobalt Ores

According to C. St. G. Campbell, of Cobalt, Ont., the all-fire scorification assay is now used exclusively by the Campbell-Dyell mill (*Bull. Can. Min. Inst.*, February, 1914), the assay being corrected in nearly the same manner as a bullion assay. It has been found that this correction offsets the losses by slag and cupel absorption, and by volatilization, and allows for impurities in the resulting silver bead. In this way the assay is made more standard than is the case when direct methods are used. It is usual to obtain a commercial result by deducting a fixed percentage from this corrected or actual assay, this percentage being acceptable to both buyer and seller.

In the pulp assay, 0.1 a.t. of pulp is scorified in a 2 3/4-in. scorifier with 50 to 60 grams of test lead, resulting in a lead button of about 20 to 30 grams. One assay is made on each of the four packets of each sample sent from the sample room, making sixteen pulp assays for each shipment (four to each of four samples). The lead buttons are brought to a uniform weight with lead foil and cupelled at a medium temperature. The cupels are made of bone ash, strengthened with a little pearl ash water.

For the metallics assay, when possible, four charges of 0.1 a.t. are taken; often, however, there is not sufficient quantity for this. Whatever the amount, it is divided into at least two charges, scorified and cupelled in the same manner as pulp.

CORRECTION TO ASSAYS

A pilot is first run using 0.1 a.t. plus 100 mg. of pulp. This results in a bead which is calculated to represent about the same amount of silver as is actually in the 0.1-a.t. charge. Similar weights of proof silver are then weighed out, one for two assays.

These "proofs," as they are called, are then scorified and cupelled at the same time in the same muffle as the assays which they control. The losses and increments which the proof bead suffers being practically the same as in the assay bead. The difference between the weight of the proof silver taken and the weight of the resultant proof bead is added to the weight of the assay bead as a correction, resulting in the corrected pulp assay. The metallics are corrected in the same manner.

New Method of Determining Potassium

The solution containing only the alkalis as chlorides (about 0.05 gram of K₂O) is evaporated on the water-bath, the residue dissolved in the smallest possible quantity of water, and the solution treated in the cold with an excess (20 c.c.) of a 2% alcoholic solution of tartaric acid, which has been stirred at intervals for several days with solid potassium bitartrate and then filtered (*Chem. Zeit.*, pp. 585 and 615, 1914). After the precipitation from 10 to 20 c.c. of 96% alcohol saturated with potassium bitartrate are added, and the liquid boiled for about 10 min. on the water-bath. It is then left (with frequent stirring) for 24 hr., after which the precipitate is collected in a weighed gooch crucible, washed first with the saturated alcohol and then with pure 96% alcohol, dried at 80° C. and weighed as potassium bitartrate. The results are in close agreement with those given by the platinum-chloride method.

The Men and Machinery of the Comstock

BY G. W. DICKIE

SYNOPSIS—The "Bonanza" days of the Comstock lode, in the '70s, produced a demand for heavy mining machinery, usually wanted at very short notice. The men who produced this machinery and who were instrumental in the development of the vast orebodies, are interesting figures in the history of machine building. Their machines, many of which have never been surpassed as to size, are monuments to the skill and courage of those pioneer designers. The author was intimately connected with a works making this machinery and his personal experience, together with anecdotes of the men he met and worked with and recollections of the mechanical difficulties to be overcome, give a vivid picture of the life of the day. This article will be followed by others giving more detailed descriptions of the work.

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During the past 20 years, I have often been asked to write about the men and machinery of the Comstock during the decade from 1870 to 1880, which period embraces the "Bonanza" times. At the close of my connection with the Union Iron Works, in 1905, I began to arrange my notes bearing upon the work done during the exciting times of the '70s and had prepared the skeleton of such a history. The notes collected at that time were lost in the great disaster that overtook San Francisco in 1906. This calamity not only deprived me of the means of doing justice to this subject, but deprived me of so much else besides that the leisure I had hoped to devote to this and kindred matters was just as effectively destroyed as the other things.

It was a notable group of men who were doing the engineering work for the mines, the steamships, and such other work as had to be done in San Francisco when I first saw the Golden Gate and the city that lay beyond it. The manner in which I first came in touch with these men may be of interest. I had been about two months in San Francisco, having come direct from Scotland with little beyond good health and a fair training in marine-engineering work. Times were rather dull and I was seeking for something better than working in the shop, so I kept watching for something that I could use as a stepping stone to reach what I was after. One day I noticed an advertisement in the papers for an expert engineer on gas works to take charge of the construction of the new city gas works, for which the Risdon Iron Works had the contract. If there was such a man in San Francisco, he was invited to interview Mr. Joseph Moore, the superintendent of these works.

Somehow I got the idea that I was the man they wanted, but before showing myself, I went to the Mechanics' Institute Library, got all the works they had on the construction and operation of gas works, studied the subject enough to be familiar with the names and usage of the various parts that entered into the construction of a modern gas plant of that day, and, on the third day, with my head full of gas and the names of all the

things necessary for its manufacture from coal, I presented myself at Mr. Moore's office and told him that I was the gas expert he had advertised for. He asked me what I knew about gas works? Then I started from the setting of retorts, the hydraulic main with its dip pipes, the scrubbers, the purifiers and all the things between them, and, when I got through, he was convinced of his good fortune in meeting just the man to carry out their contract.

GETTING TOO GOOD A REPUTATION

The work was carried out successfully, in fact the reputation I made as a gas engineer became somewhat embarrassing, as about the time the gas works was completed, the Pacific Mail Steamship Co. decided to fit their steamers with surface condensers. Mr. Waddell, their superintending engineer, was talking the matter over in the Risdon Iron Works office with Mr. Moore and both were wondering where they could possibly find a man familiar with surface condensers to take charge of this work for them. When Mr. Waddell had departed, I suggested to Mr. Moore that they put the work in my hands. "That would never do," said he, "you're a gas engineer. We must get a marine engineer who has had experience in designing surface condensers."

Feeling that I had reached the end of my career as a gas engineer, I made a complete confession of the trick I had played upon them and at once took charge of their marine work.

This has nothing to do with the men and machinery of the Comstock Lode, excepting that it was part of the way by which I was drifting into connection with the men who were designing such mining machinery as was then being built in San Francisco for the gold and silver mines on the Pacific Coast.

Here I think it proper to take a look at the iron works in operation at San Francisco in 1870 and what facilities they had in brains and tools for the work they were to be called upon to accomplish within the next five or six years. The Union Iron Works, under the firm name of H. J. Booth & Co., later Prescott, Scott & Co., had their works on the corner of First and Mission Streets. This was the oldest iron works in the city. The original owners, James and Peter Donahue, began business in a blacksmith and machine shop in a tent on the beach, where Montgomery Street now is, in 1853. The Donahues were men who saw beyond their little shop and soon began to be a factor in all the activities of the city and its harbor. They built the first gas works the city had. Their business soon required permanent quarters and they built substantial shops on the corner of First and Mission Sts.

THE NEWER UNION IRON WORKS

First James and then Peter Donahue retired from the works to attend to their individual interests, which had become quite extensive. At this time new blood came into the Union Iron Works. George W. Prescott, who had been operating a foundry in Marysville furnishing

Note—Published simultaneously with the "American Machinist."

machinery for the mines of that district, became the head of the works on First and Mission St. He had as his leading men Irving M. Scott and his younger brother, Henry T. Scott, and, on the retirement of H. J. Booth, the firm became Prescott, Scott & Co. These three men were a splendid working team, the real engineer being Irving M. Scott.

In the big things that were soon to be done on the Comstock Lode, I. M. Scott, in conjunction with W. R. Eckart, whom he had associated with him in designing the machinery required to meet the new problems which were arising, took, from the first, a leading position. The ability of these men was not only known but keenly felt by me, for whatever skill I had soon came to be set up against theirs, in deciding what was to be done and who should do it. While these battles were sometimes hard enough, the friendship we had for each other was never wounded, and, after the Comstock work was all over, Mr. Scott did not rest until I had become associated with him in other big things that the Union Iron Works had to do. I. M. Scott was not only an able engineer; he was a big man, a fine citizen and San Francisco owes much to him, both in material and moral advancement.

The Risdon Iron Works in 1870 was on Howard St., extending from Beale to Main St., and at that time was engaged in the building of mining machinery. It also had the most of the marine work, not only in repairs, but engineering the vessels built by the Dickie Brothers. I have already narrated how I became attached to the Risdon as their engineer, which position I held until 1883, a period covering the Bonanza times on the Comstock. Joseph Moore, the general manager, was a master in mechanics, a man of strong will and untiring energy. He had gathered about him the best mechanics in San Francisco at this time.

MAKING IRON PIPE TO CARRY 900-LB. PRESSURE

Mr. Moore had given much study to the manufacture of the riveted piping required for the hydraulic mines, which were then in full blast where high-pressure water was available. Pipes had sometimes to be constructed to work under a 2000-ft. head where deep ravines had to be crossed. In the case of the Cherokee pipe line, some 14 miles in length, under construction when I joined the Risdon Works, the diameter of the pipe was 30 in. At one place this pipe had to stand a head of 2100 ft., say 900 lb. per sq. in., and at this place the pipe was of $\frac{5}{8}$ -in. plate.

At that time no high-grade steel was available and the plate iron used had a tensile strength of 46,000 lb., so that the working load was considerably over 23,000 lb. and the factor of safety less than two to one, yet no breaks occurred in this pipe line during the 10 years it was in operation. A large proportion of the pipe lines of the Spring Valley Water Co., which supplies San Francisco with water, consist of riveted pipe supplied by the Risdon Iron Works.

Mr. Moore designed special tools for the manufacture of this wrought-iron pipe, consisting of automatic punching machines that punched both edges and both ends of the plates at the same time, the movement of the table carrying the plate being effected by a cam. The table was fed a little beyond the pitch, while a weight attached by a chain and controlled by a rack at each side of the table brought it back to the correct pitch.

The racks were carefully made for each size of pipe and for the inside and outside courses, so that many racks had to be carried in stock. Usually five or six holes were punched on each side or each end of the plate at each movement of the table. The accuracy of the punching by this method was a wonder to me, until I found an old Scotch draftsman in the drawing room, whose business it was to see that the racks were properly made and accurately computed for the work they had to do. When I became acquainted with Mr. Blackie and watched his method of figuring, my wonder ceased.

Hydraulic riveting machines were designed to meet the capacity of the punching machine and the rolls, whether the rivets were driven hot or cold; they were fed automatically. The wrought-iron pipe was finished in lengths of 28 ft., so as to be readily shipped on the railroad cars. The lengths were dipped in hot asphaltum before being shipped.

THE RIVAL FIRMS

These two establishments, the Union Iron Works and the Risdon Iron Works, built most of the machinery for the Comstock Lode. There were, however, other firms that were all more or less doing work for the mines. Among these was the Golden Gate & Miners' Foundry on First St. Mr. Angel and Mr. Palmer were at that time the owners of this concern. They did a safe, conservative business and were both leading men and officers in the Presbyterian church on Howard St. Notwithstanding their safe methods of doing business, they once made a mistake that hurt both themselves and their church. Having built a quartz mill for a customer, who thought he had a great mine and was able to make Messrs. Angel and Palmer think the same, stock in the mine was taken in payment. Their church, at that time, was in need of help and the two foundrymen elders, hoping to do something handsome for the institution, presented it with a lot of this stock, but even with the blessing and prayers of the church, nothing worth milling came out of the mine. The stockholders had to pay assessment after assessment and the church was almost ruined by the benevolence of the Golden Gate & Miners' Foundry, and no one regretted it more than Mr. Angel and Mr. Palmer, who were both fine men.

The Fulton Iron Works, on Howard at Fremont St., at the time of which I am now writing, was also doing considerable work for the mines. The proprietors of this establishment were Messrs. Hinkley, Spears and Hayes. Mr. Spears was the engineer of the firm, a Scotchman and an able mechanic. After the death of Mr. Spears, the business of the Fulton Works did not prosper and it was finally closed.

The Pacific Iron Works, on First St., was also doing a good deal of mining work and, during the Comstock days, did work as subcontractors for the Union Iron Works, when their orders were too numerous to handle. The Pacific Works, however, did no original designing for any of the big machines on the Comstock. That was all done either by the Union Iron Works or the Risdon, and these two establishments were credited by those who knew something of the conditions prevailing at the time, as being the engineers in fact for the two groups of financiers that controlled the mines on the Comstock.

The Union Iron Works had the first chance on any new machinery required by the quartet known as the

"Bonanza Kings," Mackey, Fair, Flood and O'Brien, while the Risdon Iron Works had first chance with what was known as the "Bank of California Crowd," Sharon, Ralston, Harmon and Requa. The Bonanza crowd usually had control of the mines on the north end of the Comstock Lode, while the Bank of California Crowd usually had control of the south end mines.

The two men at Virginia City who were supposed to be the engineers responsible for the machinery installed in the various mines were W. H. Patten, for the work done for the Bonanza crowd; and I. F. Thompson, for the work done for the Bank of California Crowd. These two men became prominent factors in the installation of the heavy machinery built for the Comstock between the years 1872 and 1878. When developments took place in any of the south end mines requiring something in the way of hoisting or pumping works beyond what had been done before, Mr. Thompson would be at the Risdon Iron Works next day with the problem that had to be solved, and we would at once get all our thinking capacity centered upon its solution. Plans would be started at once, showing in a general way the direction our thoughts were taking.

Specifications would be prepared as the plans became visible and, by working far into the night, in a few days plans, specifications and estimates would be ready, the estimate being liberal enough to provide for all contingencies. Then, without loss of time, the directors of the mining company interested would meet, Mr. Thompson would present the plans as his solution of the problem to be met, with the specification and estimate from the Risdon Iron Works, which he would recommend as reasonable under the circumstances, and, as time and stockholders were pressing, the usual course was to order the work. Next morning we would be busy with the details and the cylinders and bed plates would be in the pattern shop before final details of valve gear and connections were decided upon. Should the problem be at the other end of the Lode, Mr. Patten would have gone through the same program with the Union Iron Works.

CLOSE RIVALRY FOR A CONTRACT

Sometimes the securing of a contract was not such a sure thing. An outside mine might be ambitious to have a big plant like those on the Comstock Lode, then there would be competition of brains as well as of influence. Toward the close of the Bonanza period, the Eureka Consolidated of Nevada people had an idea that if they could reach the depth of the Comstock mines there would be a chance of opening up a great body of ore. So the directors determined to reach the 2000-ft. level and that as soon as possible. New and large pumping and hoisting works would be necessary, as the plant they already had would reach its limit at 1200 ft. They invited the Union and Risdon Iron Works to present plans and specifications of what they should have and they stipulated that these plans should be presented to their board of directors at 10 o'clock in the morning on the sixth day from the date of their invitation. Next morning, Irving M. Scott and myself were on the train bound for Eureka, Nev., and, as luck would have it, we had the same section in the sleeper. All the way up we chatted pleasantly together for we were good friends, even during the time we had to fight each other. At Eureka we went over the mine together, taking notes of all the conditions,

but neither of us by word or sign giving any hint to those in charge of the mine or to each other what we thought of the problem. On the way home we talked of everything except what we were thinking of.

I had, however, telegraphed from Eureka, to have our chief draftsman, a Mr. Sherholtz, one of the quickest men I ever knew at getting an idea on paper in presentable form, to be at my house on the evening of my arrival at 6 o'clock with plenty of paper and his instruments. We arrived on Friday evening at 5 o'clock and the directors of the Eureka Consolidated were to meet at 10 o'clock on Saturday morning in the Nevada Bank building. I had been thinking it over on the train and before reaching home had my plan decided upon. Mr. Scott was, no doubt, equally prepared. At about 7 o'clock in the evening my man and I went to work. While he worked on the plans, I worked both on the specifications and the estimate. At seven o'clock in the morning we were both ready for business.

DODGING THE OTHER FELLOW

Just before 10 o'clock I walked leisurely down Pine St. and turning the corner at Montgomery, my eye caught George W. Prescott's back as he walked in front of the main entrance of the Nevada Bank building. This convinced me that Scott was not ready and that Mr. Prescott was watching for me to enter that he might ask for a delay till Mr. Scott appeared. Turning back to Kearney St., I went from there through the old California Market to the rear door of the Nevada Bank building and got into the building that way. I found the directors of the Eureka Consolidated already in session and, as they were ready to take the matter up, I at once unfolded to them my plans and specifications, explaining the advantages of the hydraulic system I had adopted, and by 11 o'clock they were ready to consider the cost. This I was ready for and I had a contract which I handed to Judge Hydenfeldt, president of the company. He pronounced it satisfactory and remarked that as the Union Iron Works had not put in an appearance, he would consider a motion to either adjourn or award the contract to the Risdon. They decided to award the contract, which was duly signed, and, as I was folding up my papers, I. M. Scott came rushing in with his plans, just five minutes late. That was the only time I got the better of Mr. Scott—it was generally the other way.

Mining Reconnaissance of Northern Brazil

BY HENRY C. CARR*

There is, at the present time, no country so thoroughly unknown as the northern part of Brazil, especially that part north of the parallel 15° S. It is more of a *terra incognita* than darkest Africa. I have had the good fortune to make a trip of about six months' duration in the northern states of Ceara, Piauhy and Maranhao, and this article is written regarding those three states.

With the exception of a few insignificant mountain ranges (the highest point in northern Brazil being 3000 ft.), these three states are one large plateau with an average elevation of 70 m. above sea level and with the

*Mining engineer, care of Lindon Bates, 71 Broadway, New York.

highest part of the plateau 470 m. This plateau contains absolutely none of the precious metals, although at a place called Borracho Fonda, about 100 miles east of Therezina, in the state of Piauh, there is an extinct crater, with numerous fumaroles, and in the district small diamonds may be found by panning. Probably if shafts were sunk in this crater, commercial diamonds would be found.

On the Atlantic coast of the state of Piauh, I was shown samples of galena. It was high grade so far as lead content was concerned, but low in silver, 5 to 10 oz. This ore occurs in the Devonian limestones of that region and is worthy of investigation. On the boundary line between the state of Maranhao and Para, are some low-lying mountains, or rather hills of schist. There are three rivers flowing from south to north in this region, called the Turyassu, Guajahu and Gurupy. Ever since the first colonists arrived in Maranhao (San Luiz), some hundreds of years ago, they have been receiving gold from the Turyassu; this gold comes from the Indians there, and what I saw was comparatively coarse and not rounded. I should judge that the Indians pound up these schists and small quartz veins, and pan the gold. It is high grade, running \$19 per oz. Up to date it has been impossible to go into this Turyassu country on account of the hostility and savagery of the Indians, but if the receipts of gold at Maranhao and Para from this region are any criterion, then there must be considerable deposits there, but whether commercial or not, I do not know. The only way to explore that region would be for an armed party to go there with the consent of the Brazilian Government.

Transportation in Brazil is the simplest problem. It contains more navigable rivers than any other country on the globe. To go to the districts mentioned, the traveler takes a Booth line boat to Para. From there he can get a first-class boat of the Lloyd Brasileiro to Maranhao, and then return to Turyassu by schooner (90 miles), or he can wait at Para and get a regular coasting steamer which stops at all these places along the coast. Food is hard to procure in the interior, and the traveler should make up his mind to be content with beef, rice, beans and farina solely. Bread and vegetables are an unknown quantity. The climate is perfectly healthy half a mile away from any river, and it is only in the Amazon region that the jungle is continuous. In the rest of Brazil, the country is entirely similar to our plains country in the western part of the United States, but with many more shade trees. Away from the rivers, also, there are no mosquitos, and even on the rivers they cannot compare for quantity and viciousness with those in the mining district of Canada and British Columbia. Neither did I see a snake of any kind, nor a poisonous insect. There possibly may be the same insect life in Brazil as there is in Mexico, but I did not see it.

In conclusion, I will say that northern Brazil, in my estimation, does not hold out any inducements to the prospector, with the possible exception of the Turyassu and the limestone hills in northern Piauh. The Piauh natives are obliging and courteous, also exceedingly lazy, and no dependence can be placed on them from the labor standpoint for any length of time. Possibly the climate militates against continuous hard labor. Steamboat fares up the rivers and along the coast are high, but what food can be bought in the interior is ridiculously cheap. The advantages to come from northern Brazil are from

rubber, hardwood, cattle and cocoa, and anyone with a small amount of capital and a large amount of industry can easily accumulate a fortune there. I might say also, that these three states produce the finest cotton in the world. Trees are planted every seven years and produce a very fine long staple cotton, which is shipped to Portugal and Liverpool.

Pig Iron Production in 1914

The Bureau of Statistics of the American Iron & Steel Association has collected and published the statistics of production of pig iron in the United States for the half-year ended June 30, 1914. The statement is as follows, compared with the two previous years, the figures being in long tons:

	1912	1913	1914
First half-year.....	14,072,274	16,498,602	12,536,094
Second half-year.....	15,654,663	14,477,550	.....
Year.....	29,726,937	30,966,152	.....

The production for the first half of 1914 shows a decrease of 1,941,456 tons, or 13.4% from that of the second half of 1913; and of 3,952,508 tons, or 23.6%, as compared with the first half. The make for the half year was the smallest since the second half of 1911. The maximum production reached in any one year was in the 12 months from July 1, 1912, to June 30, 1913, when 32,143,265 tons were made.

Classed by fuels used in the first half of this year, 12,260,020 tons of iron were made with coke; 74,800 tons with coke and raw bituminous coal mixed; 55,612 tons with coke and anthracite mixed; 1895 tons with anthracite alone; 145,767 tons with charcoal. The charcoal iron includes a small quantity of iron and ferroalloys made in the electric furnace.

The production of pig iron by grades is reported as below, in long tons:

	1913		1914
	First Half	Second Half	First Half
Basic.....	6,510,011	6,026,682	5,010,647
Bessemer.....	6,127,048	5,146,247	4,247,464
Low-phosphorous.....	158,918	157,900	130,634
Foundry.....	2,834,821	2,279,807	2,377,610
Ferrosilicon.....	46,181	59,534	76,930
Malleable.....	482,702	510,834	383,139
Forge pig.....	182,877	141,536	197,483
Spiegeleisen.....	56,856	53,482	36,939
Ferromanganese.....	54,387	65,108	49,215
Miscellaneous.....	34,607	36,420	26,033
Total.....	16,488,602	14,477,550	12,536,094

Miscellaneous includes white and mottled iron, direct castings, ferrovanadium, ferrotitanium and other alloys. Basic pig in 1914 was about 40%; bessemer and low phosphorus, 35%; and foundry 19.5% of the total.

The forms in which the pig iron made in the first half of 1914 was delivered is given in the following table, comparison being made with the first half of 1913:

	1913		1914	
	Tons	%	Tons	%
To steel furnaces, molten.....	9,069,845	55.0	6,536,668	52.1
Sand cast.....	3,685,512	22.3	2,744,975	21.9
Machine cast.....	3,246,964	19.7	2,862,674	22.9
Chill cast.....	480,503	2.9	38,247	3.1
Direct castings.....	5,778	0.1	7,530	0.1
Total.....	16,488,602	100.0	12,536,094	100.0

Of the pig iron made in 1914, a total of 8,468,388 tons, or 67.6%, was made for the consumption of the manufacturers in conversion into steel or other forms; while 4,067,756 tons, or 32.4%, were made by merchant and other furnaces for sale. A comparison will show that 77.2% of the steel furnace pig was delivered in molten form to mixers, converters or openhearth furnaces.

In the half-year there were 275 stacks in blast for all or a part of the six months. The number in blast on June 30, 1914, was 208, of which 189 used coke or bituminous coal, 5 anthracite and 14 charcoal. The total number of completed furnaces on the same date was 457; there were three new furnaces in course of erection and 13 being rebuilt. These furnaces will have a capacity when finished of 505,000 tons of iron yearly. During the half-year five furnaces were abandoned or dismantled, their total capacity being 200,500 tons yearly. This shows a net gain of 304,500 tons in producing capacity.

"Radium Starvation"

The New York *Evening Sun* prints the following sane comment on the radium situation:

There is some talk now of pressing the Foster radium bill through Congress as an emergency measure. The war in Europe is apparently to be used as the final and conclusive argument, and we are warned that if the bill fails to pass the whole world will suffer horribly for want of radium. The British railways were taken over by the Government as soon as war was declared, so why, argues one disinterested enthusiast, why in the world should not our Government take over the whole radium industry and nationalize it? People are dying by the thousand of cancer and Congress has hitherto done nothing at all to help them. Now if only it make haste, pass the Foster bill and put the whole business in the hands of Government officials think what wonders they could work in the way of saving lives!

"Radium for the people" is an inspiring cry, if only we knew exactly what it meant. We hear a great deal about the country facing "radium starvation," about the impossibility of securing radium at any price on account of the great foreign demand; but what bearing the war has on all this it is not easy to see except that it is manifest that the exportation which the enthusiasts are so fond of lamenting will be checked while the war lasts. Nor is it by any means obvious that the Government would work the business more economically than it is worked to-day. It is true that Mr. Lane last year delivered himself of a great deal of rhetoric, but he failed to show any deep knowledge of the subject and his arguments gave the unfortunate impression that he had been coached by persons not quite so thoroughly disinterested as himself.

Why the Government should take over this particular industry more than another it is very hard to tell. We can readily understand why some deserving persons would be glad to see a Government radium bureau established, and we have no doubt that it would supply plenty of welcome jobs. But apart from that there is no apparent reason why the Government should meddle in the matter at all. If it were not that popular excitement had been industriously and skillfully worked up and the merits of radium grossly exaggerated by interested persons no one would ever have dreamed of supporting so preposterous a measure.

Orsk Goldfields, Ltd.

At the annual meeting of the Orsk Goldfields, Ltd., in London, recently, the chairman reported that the total gold output for the 1913 season amounted to £48,933, of which £3740 was produced by tributers. The operating cost for the two dredges, including payment to tributers and winter upkeep of the plant, amounted to £15,109, leaving a gross working profit of £33,823; but the Russian administration charges, royalty, depreciation and interest on loans brought the net profit down to £679, according to the London *Financial Times*. This company operates two dredges in eastern Siberia. One, the Kolchan, is an 8-cu.ft. Empire all-steel dredge, electrically operated, power being supplied from the Lake Chla plant, which uses wood for fuel; the other dredge, now known as the Pokrovsky, has 3½-cu.ft. buckets and is operated by steam.

The conversion of the Pokrovsky dredge was one of

the interesting features of this company's operations. Digging was originally begun with a drag-line excavator, which delivered into a sluice. Washing in this way proved unsatisfactory and the so called "stacker-scow" plant was then built, the drag-line excavator delivering into washing equipment erected on a scow, which was also equipped with a swinging stacker so that tailings could be delivered as from an ordinary dredge. The stacker-scow plant was found expensive to operate, and was shut down on Oct. 8, 1912, to be remodeled into the steam-driven dredge, known as the Pokrovsky.

The expenditure of about £13,000 in the conversion of the stacker-scow plant into a 3½-cu.ft. dredge was considered justified by the reduced operating expense of the new Pokrovsky dredge. The total cost of operating the dredge in 1913 was £4243, while that of the stacker-scow during the previous season was £4268, the yardage handled being 117,500 and 68,645 cu.yd., respectively. Thus the working cost of the dredge was 17.5c., as against 30c. per cu.yd. for the stacker-scow plant.

The converted Pokrovsky dredge began operation on June 28, 1913, and continued until Nov. 13, a period of 139 days, during which time 117,500 cu.yd. of gravel were washed, which yielded gold to the value of £15,464, an average of 63.8c. per cubic yard.

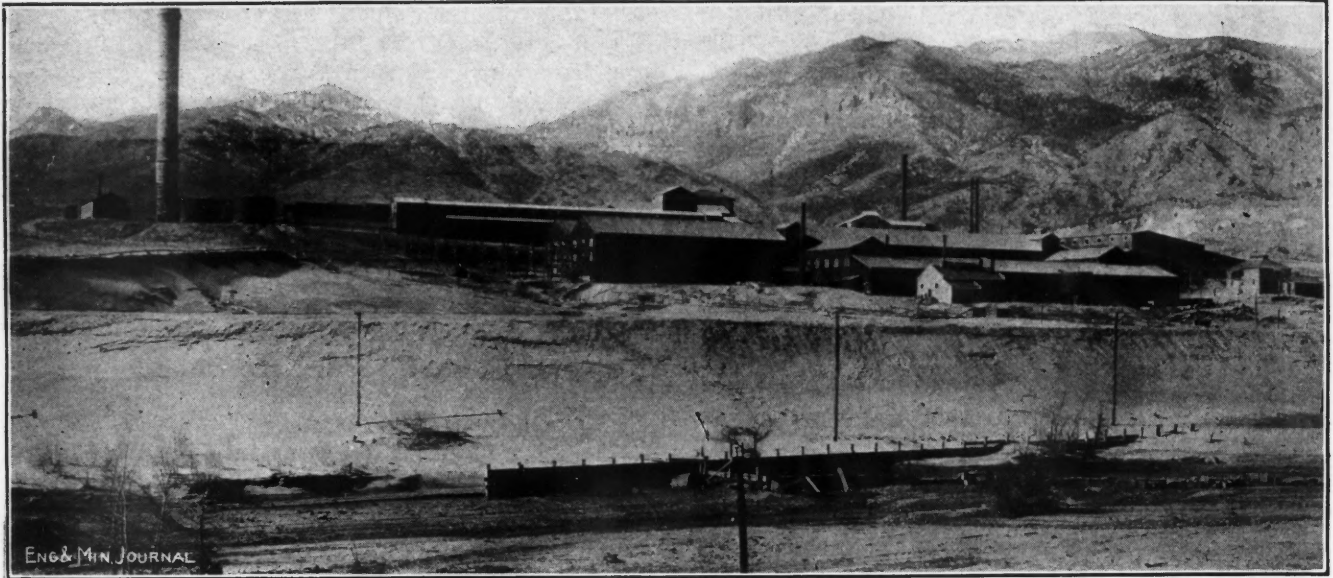
The Kolchan dredge commenced operating on May 8, 1913, and continued until Nov. 13, a period of 190 days, as against 174 days in 1912. During the 1913 season, 382,800 cu.yd. of gravel were treated, recovering gold to the value of £29,727, an average of 38c. per cu.yd. as against 32c. in 1912. Tributers were allowed to work portions of Kolchan and Pavlovsky creeks, where the ground was inaccessible to dredging and not rich enough or extensive enough to warrant a company in undertaking independent operations.

On account of the financial position of the company, the directors reduced their fees by £125 (the remuneration according to the articles of association being £250 per annum) and a further saving of £150 per annum was effected through obtaining the consent of the technical adviser of the company to cancel his contract; office rent has been reduced £200 and the company's responsible agent in Russia has reduced his fee by £100 per annum. The question of dispensing with the imported staff altogether during the winter months, when the dredges are shut down, was considered, but it was found that it would be more costly to bring the men in again at the beginning of the following season than to retain them on the property during the winter months doing necessary repair work. Moreover, owing to difficulties of transport in the early spring, the staff would not be able to reach the mine in time to commence dredging operations at the opening of the season, and this would curtail an already too short dredging season.

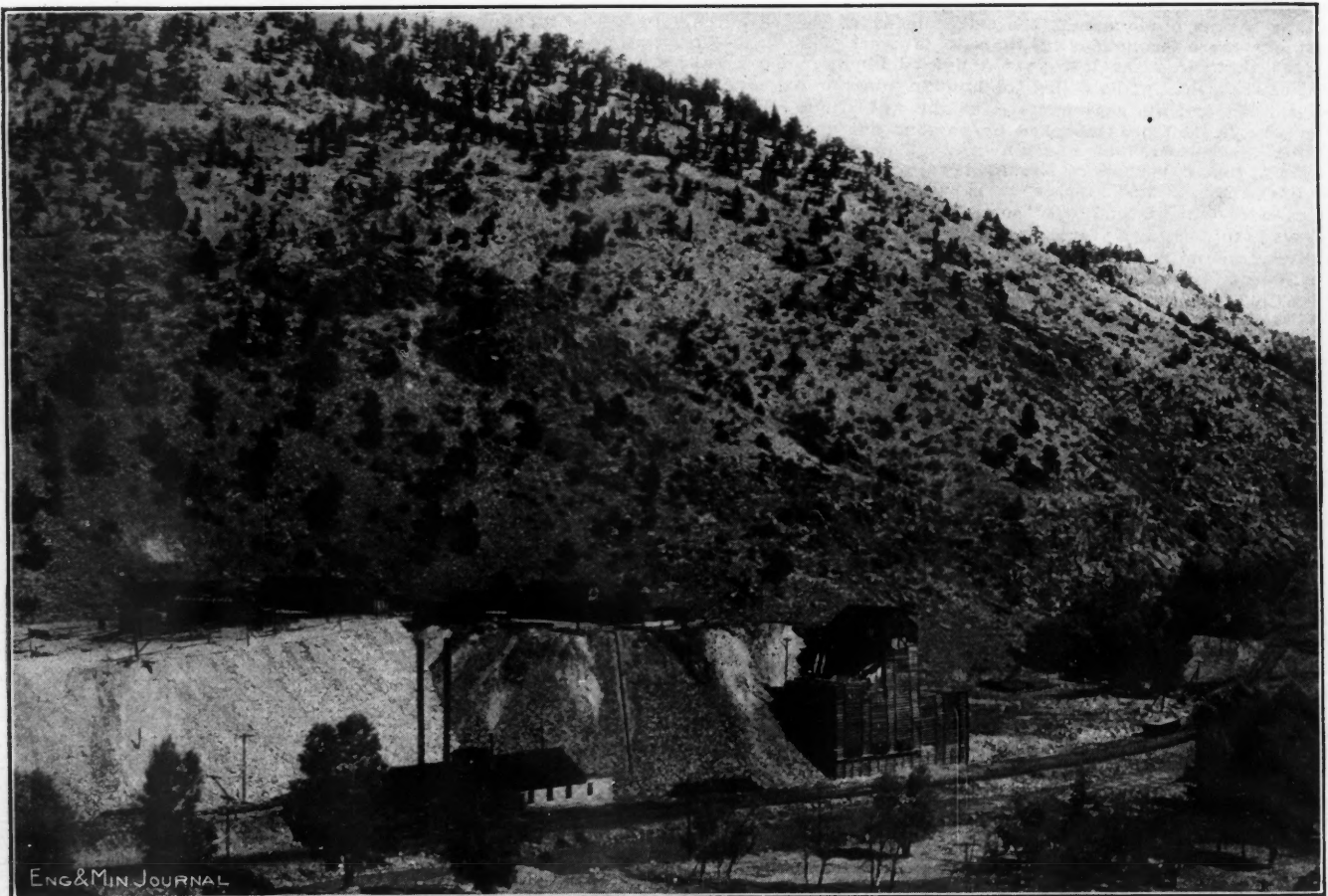
As regards the current season's work, the chairman announced that the two dredges began work about the end of April and up to the middle of July had dug 256,200 cu.yd., yielding gold to the value of £13,490. More tributers are at work this season. While the dredges are working in lower-grade ground in 1914, a much greater yardage is expected to be handled. W. H. Lanagan is in charge of the Siberian operations.

The Phosphate Rock Marketed in 1913 was 3,111,221 tons, according to the U. S. Geological Survey, of which 2,055,482 tons was pebble rock from Florida, 489,797 tons Florida hard rock, and 451,559 tons Tennessee rock.

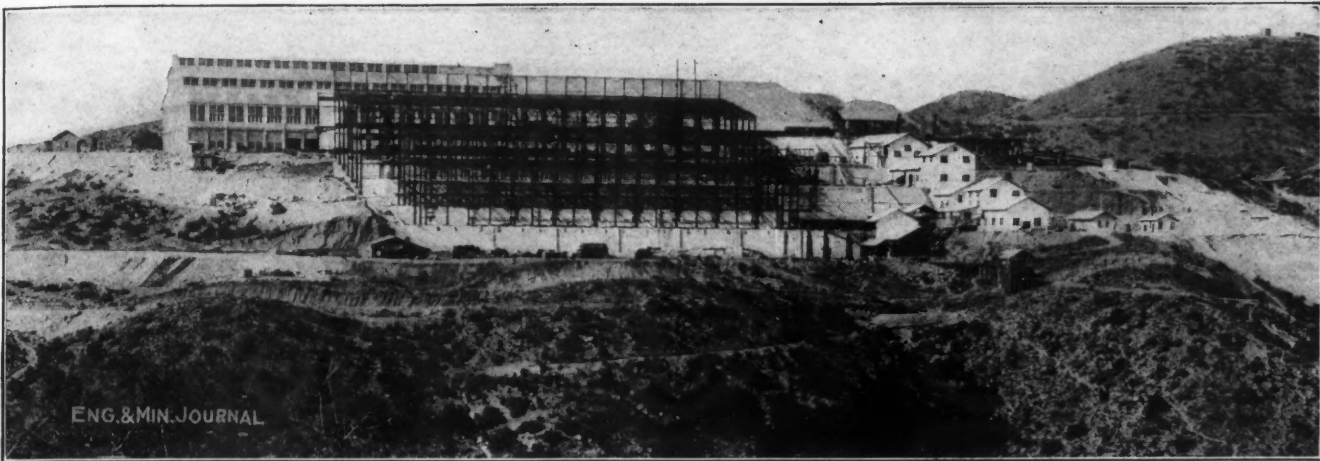
Photographs from the Field



THE GOLDEN CYCLE MILL, COLORADO CITY, COLO.

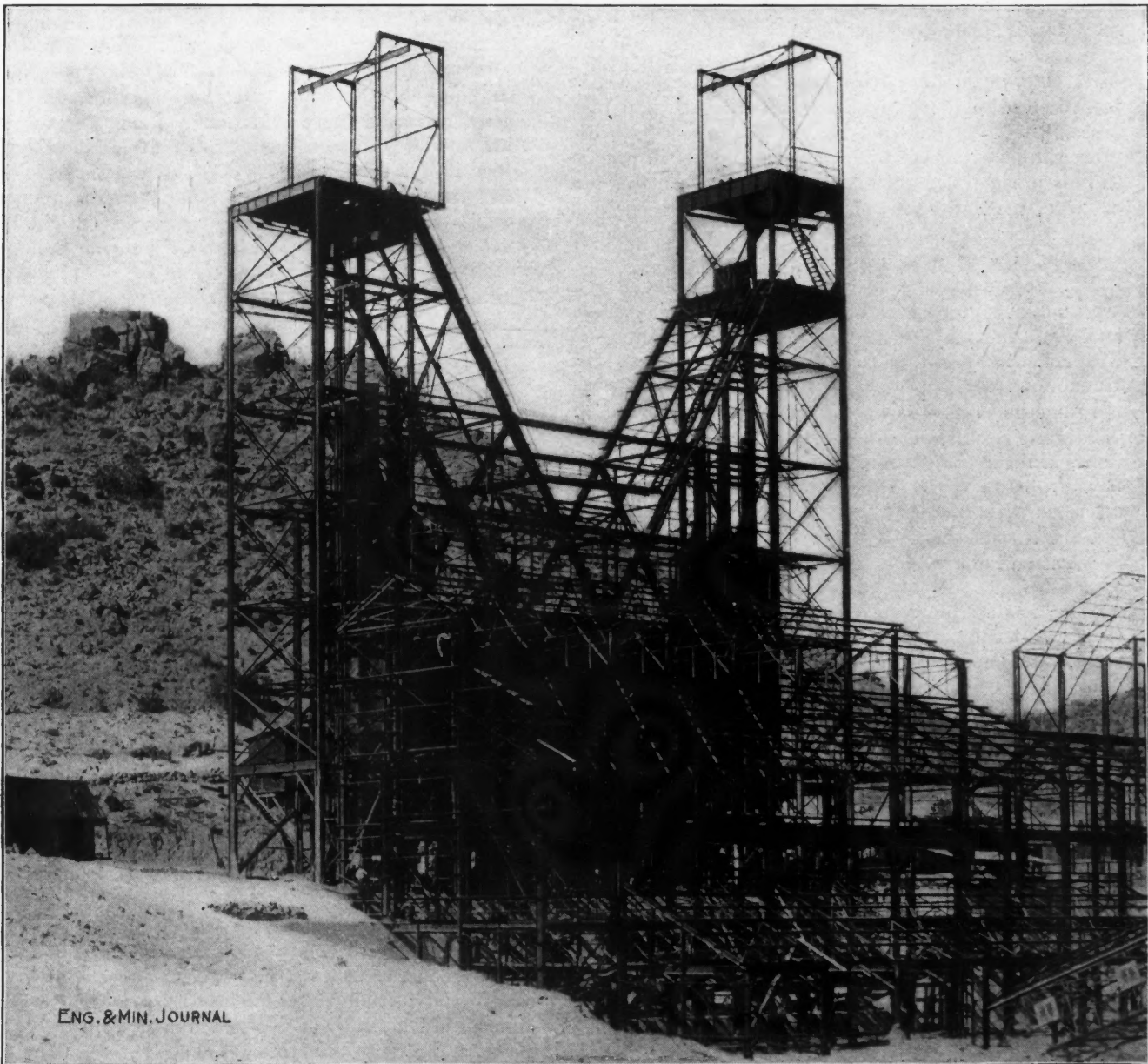


PORTAL OF THE NEWHOUSE TUNNEL, IDAHO SPRINGS, COLO.



CONCENTRATOR, TEST MILL AND SHOPS OF INSPIRATION COPPER CO., MIAMI, ARIZ., FROM BELOW

In point of tonnage developed Inspiration is the sixth largest copper mine in the world, and the fifth largest in this country



THE TWO MAIN HEADFRAMES AND CRUSHING PLANT, INSPIRATION COPPER CO.

These two shafts will be operated from the same hoist house, but will be independent units, capable of raising 7500 tons per 14-hr. day

Correspondence and Discussion

A Comparison of the Huntington-Heberlein and Dwight-Lloyd Processes

In view of Mr. Norton's many favorable words for the Dwight-Lloyd process in general, I hope it may not seem ungracious if I question some of his arguments. I am particularly interested in his comments on the smelting of the two classes of product, because his views do not seem to coincide with those generally held by metallurgists who have had experience in this special line. I shall therefore give more attention to the smelting of the sinter than to the sintering operation itself, though I shall add a few brief comments on that subject too.

As Mr. Norton very truly says, there have been many preconceived notions as to what the Dwight-Lloyd process could or could not do, some of which have been proved to be erroneous by later developments in practice. This is probably true of all new processes. In this present case, the limitations of the process have been found to be wider and its flexibility actually greater than its sponsors ever allowed themselves to claim for it.

Mr. Norton and his assistants have worked out their own special sintering problem in an admirable manner, and the same may be said of many other plants, each with some local feature that gives the problem an individual interest. Through all these variations, however, the same general rules hold true, which if followed will yield good results, or quickly show the desirable limitations, while if transgressed or ignored, will surely defeat the purpose in view. These general principles have been discussed before and will not be repeated here.

I am at somewhat of a disadvantage in this discussion by reason of the evident impropriety of my publishing operating data of any of the Dwight-Lloyd licenses without having previously obtained permission, so that the facts I may present must be more or less impersonal. Perhaps the metallurgists themselves may be interested to tell their own story. Mr. Norton's chief argument is directed against the idea that the Dwight-Lloyd sinter is any better material for the blast furnace than the Huntington-Heberlein product. He supports this by citing two experimental furnace runs, as follows:

(a) Record of one five days' run of the Murray furnaces in August, 1912, wherein a single furnace, smelting Dwight-Lloyd sinter, showed slightly poorer reduction than the other four furnaces smelting Huntington-Heberlein product.

(b) Record of another run of two days in the same month and year, which showed that three furnaces smelting Huntington-Heberlein product developed an average speed of seven tons per furnace day (2½%)

Note—This is a discussion of W. W. Norton's comparison of the Dwight-Lloyd and Huntington-Heberlein processes, read at the Salt Lake meeting of the A. I. M. E., and it has also been sent to the Institute.

higher than the two furnaces smelting Dwight-Lloyd sinter.

Mr. Norton evidently does not take much stock in the arguments based on theoretical advantages of Dwight-Lloyd sinter, due to its physical condition, open structure, large surface of contact with the reducing gases, intimate mixture of slag-forming ingredients, etc., so I shall not attempt to rehearse any of them. Instead, I will advance some facts selected as typical from a wide field of practice which has come under my observation, with some suggestions and explanations.

REDUCIBILITY

(a) To discuss a furnace record like that quoted by Mr. Norton for the five days' run in August, 1912, is manifestly difficult for an outsider, but a possible explanation for the poor reduction on Furnace No. 5, smelting Dwight-Lloyd sinter, may lie in the fact that both sets of furnaces carried the same fuel charges. Other things being equal, if 11½% coke was right for the furnaces smelting Huntington-Heberlein product, it was too much for the furnace smelting Dwight-Lloyd product, as I shall endeavor to show later, and incipient overfire, accompanied by higher lead in slag and matte, was induced. It may sound like a paradox to say that excessive fuel sometimes produces poor reduction, but it is a sad fact.

In certain plants where practically the entire charge to the blast furnaces receives a preliminary treatment by being sintered on the Dwight-Lloyd machines, the peculiarities of this problem have had to be carefully studied, for serious metallurgical difficulties presented themselves when the charge was first made up of Dwight-Lloyd sinter in large quantities. Some of these plants had blast-pots before they had Dwight-Lloyd machines, and many opportunities were afforded for comparative study of this point. There is reason to believe that, due to the long period of blowing and the higher temperatures developed in the pots from greater mass action, the iron in the Huntington-Heberlein product is present chiefly as Fe_2O_3 , perhaps in the form of ferrites, while in the Dwight-Lloyd product the iron is present as FeO . The fuel charge in the blast furnace must be so proportioned as to meet exactly the chemical and thermic requirements of reduction and melting. If any of these functions have been performed before the material enters the furnace, a corresponding allowance should be made or the fuel balance will be disturbed, and bad work will result.

One of the functions of the coke is to reduce enough metallic Fe for the matte requirements, leaving the remainder of the iron as FeO to go into the slag. In smelting almost any other material than Dwight & Lloyd sinter, the iron must be reduced from the higher oxides, Fe_2O_3 or Fe_3O_4 to the protoxide, FeO , before a true comparative basis is reached. Experience has shown that with about one-half Dwight-Lloyd sinter on the charge, the coke should be cut about 10%. This figure has been

reached by experiment, but the following calculation explains its reasonableness: As a fairly average case, let us assume 100 tons of blast furnace charge, of which 50% is Dwight-Lloyd sinter carrying 16% Fe, present as FeO instead of Fe₂O₃. 16% of 50 tons = 8 tons Fe as FeO. To reduce this 8 tons Fe from Fe₂O₃ to FeO would require 0.857 ton fixed carbon or practically one ton good coke, assuming the reduction is accomplished by the agency of CO gases (an assumption that is probably not realized in lead-smelting practice). However, on that assumption, the saving in coke will be close to 1 ton of coke in 10, or 10% of the coke required for smelting ordinary ore, or Huntington-Heberlein product.

This theoretical benefit is borne out by the practical blast-furnace results on a large scale in numerous plants. In fact, wherever this important factor is ignored the evil symptoms of excessive fuel will be indicated, one of which symptoms is a diminished furnace speed with tendency to over-fire, and as every metallurgist knows, this is likely to be accompanied by poor reduction in slags and mattes, especially if the mechanical features of the problem, such as size of lumps and distribution in the furnace, have not been correctly adjusted. This general fact has been quite convincingly proved, at least to my own satisfaction, by the numerous cases where I have been called upon to observe difficulties and recommend remedies in connection with the growing use of Dwight-Lloyd sinter in smelting operations. It may be confidently stated that some changes in furnace adjustment are necessary to get the best results out of Dwight-Lloyd sinter in the blast furnace, but an intelligent study of the problem will yield fruitful and economical results.

To put the matter tersely, and emphasize the important point I wish to make, the successful smelting of Dwight-Lloyd sinter not only *permits* of economy of coke, but actually *demand*s it.

FURNACE SPEED

(b) In the furnace record of Aug. 12 and 13, 1912, when the furnaces smelting Dwight-Lloyd sinter ran a trifle slower than those with Huntington-Heberlein product, it is to be noted that the former carried 580 lb. iron ore on the charge, while the latter required 1140 lb. iron ore, indicating that the Dwight-Lloyd sinter was itself high in iron. It is well established that a basic sinter does not smelt as fast as one in which the proper proportion of SiO₂ and FeO for the slag is approximately maintained. This may or may not be the reason in this case, but it is worth mentioning.

The following figures were furnished me some time ago as giving the comparison of average furnace speeds in a certain plant where the character of the charge sent to the blast furnace was gradually improved by the introduction of modern methods of preliminary treatment. The furnaces in question were 48x162 in. (54 sq.ft.) at the tuyeres, and the averages were taken over considerable periods of time:

	Average Tons Smelted per Fur- nace Day	Tons per Sq.Ft. Hearth Area per Day
(1) With Brückner roaster product....	180	3.3
(2) With Huntington Heberlein product	200	3.7
(3) With H. & H. product and ore fines largely removed by screening...	227	4.2
(4) With Dwight & Lloyd product and ore fines largely removed by screening	285	5.3

Case 4 shows a gain of 25% over Case 3.

In another Western plant, the addition of Dwight-Lloyd sinter to the charge increased the furnace speed from 140 tons per day to 175 tons per furnace day, a gain of 25%. In still another case, the increase was from 180 tons to 210 tons, an increase of 17%.

Mr. Norton expresses his belief "that a partly fused" or "predigested" combination may tend to poor results rather than good results when smelted, for the reason that such substances fuse at too low a temperature in the furnace. I fully recognize this as a possibility and indeed a probability, when Dwight-Lloyd sinter is treated without due regard to its properties, but I positively assert that such tendency can be quickly and easily met with no change from ordinary standard furnace equipment, and with distinct fuel economy, as has already been pointed out.

A pertinent citation on this point is the experience of a smeltery superintendent who had to carry a considerable amount of leady converter slag on his charge. He was much troubled by premature fusion of this ingredient until he discovered recently that by crushing it and adding it to the charge of his Dwight-Lloyd sintering machines he was able fully to control this tendency, and is now regularly following this practice.

SULPHUR RANGE AND ELIMINATION

The general experience has been that higher initial sulphurs can be handled by the Dwight-Lloyd than by the pots. This is to be expected from the smaller mass under treatment at one time and the mechanical means for rapidly abstracting the heat as it is developed by the oxidation of the sulphur. As an example, one plant figures its Dwight-Lloyd charges between 12 and 14% sulphur, and its Huntington-Heberlein charges for direct conversion at 10 to 11% sulphur.

There are many data available to indicate that the Dwight-Lloyd is at least as thorough in sulphur elimination as the pots, with a far greater efficiency per unit area of plant.*

The Huntington-Heberlein plant at Murray has about double the capacity of the Dwight-Lloyd plant. The operating cost per ton is necessarily influenced by this fact. If the costs were corrected to an equivalent basis, the small difference in favor of the large Huntington-Heberlein plant would probably be more than wiped out. Without going into details, it may also be said that a true comparison should include all the pertinent items, such as interest on investment, depreciation, etc., which would unquestionably throw the balance in favor of the Dwight-Lloyd. In this connection, I wish to say that the Dwight-Lloyd process is most distinctly on its mettle at Murray, for Mr. Norton has worked out the Huntington-Heberlein process to an extraordinary degree of perfection, and his practice in that department justly ranks among the best.

As Mr. Norton says, the Dwight-Lloyd machines have to handle the very fine material that the pots cannot treat. In many plants, this includes also the fines from the pots. In other words, the machines have to do the dirty work, because they can; but it is only fair to ask how the figures would be affected if the Huntington-Heberlein pots had to take their share of the very fine material.

*"Efficiency in ore roasting," A. S. Dwight, "School of Mines Quarterly," Nov., 1911.

LEAD LOSSES

Mr. Norton does not attempt to present any conclusive data on this point. As the volatilization is influenced largely by the temperature, and the time the charge is subjected to the heat and air currents, the advantage ought theoretically to be with the Dwight-Lloyd, for in that process a given particle is undergoing the heat treatment about as many minutes as it is hours in the Huntington-Heberlein pot. Investigations of lead losses have been made by various plants, some of which will probably be published some day; meantime, it can be stated that while it is possible to establish conditions which will make a Dwight-Lloyd machine into an efficient lead burner, it is not *necessary* so to do, and the lead losses should be less than with the pots. As an example, in one plant under my direct observation where pots have been entirely superseded by Dwight-Lloyd machines, the lead loss was about 3% in the pots and is now about 0.75% as the average over a period of two years with the machines.

ARTHUR S. DWIGHT.

New York, Aug. 21, 1914.

Erroneous Results from Angle-Hole Drilling

In the JOURNAL, July 4, 1914, Frank A. Glass writes on "Erroneous Results from Angle-Hole Drilling," referring the reader to diamond- and churn-drilling operations in the Cuyuna iron-ore district of Minnesota. Mr. Glass states that angle-hole drilling has no place in a large part of the Cuyuna district. His citation of a case involving what he claims a loss of nearly \$100,000 I know is what prompted him to write the article. He makes of it a case of the tail wags the dog. His article also contains some serious mis-statements and important conditions are omitted, which, if duly considered, would modify his conclusions. Inasmuch as I have been responsible for the drilling of at least 90% of all the angle holes drilled in the district, I feel disposed to make a few brief statements to clarify the situation.

From the article as written, readers have difficulty in following Mr. Glass' distinctions and in determining whether he is arguing for or against all diamond drilling, or angle-hole drilling in general, or diamond-angle-hole drilling in ore, especially in their wider application. The three are involved in his article and citation. I maintain they are all important and desirable, each in its place, and are not always beset by constant dangers and risks, as he maintains.

In the money loss cited by Mr. Glass, the question of the real value of the ore enters, and his loss should not be charged against the drilling. In addition, better judgment should have been displayed by the original lessees drilling the angle holes on that property when they saw that their first angle holes recovered little or no samples. I am familiar with the property for I subsequently directed the later drilling for the new lessees.

In discussing Cuyuna ores and orebodies, it is necessary to consider separately the northerly and southerly portions of the district. Locally, these portions are known as North and South Ranges. Conditions are materially different from several standpoints, enough so to influence the plan of explorations. Mr. Glass' deduc-

tions are based on the drilling of a North Range property. Probably 95% of all the angle holes in the district are on the South Range. Everywhere drilling operations are now at low tide, and little drilling has been done on the South Range for two years, although it embraces twice as much, or more, explorable land than the North Range. These being the facts, because the boilers are cold and the drills off, Mr. Glass curiously enough concludes and states that "angle-hole drilling has been practically abandoned in favor of vertical drilling." There is a large amount of drilling to be done on the South Range, and there the structural conditions alone virtually demand angle-hole drilling, diamond or churn.

On the South Range, the ore formation is narrow, finely bedded and steeply inclined, dipping at an average of 80° or more, and apparently has little cross-folding. In many deposits there is a southward dip of 80° at one end and a northward dip of 80° at the other end, passing through the vertical at about the middle. Under these conditions, angle holes are decidedly preferable. Disintegrated chert is absent, and quartz veins are relatively immaterial, hence present obstacles neither in sampling nor in drilling. Vertical holes are here likely to follow a single bed, and even where they do cut across several beds they can be but few in number, and such a hole cannot give the amount of information that one angle hole would which necessarily cuts across nearly all of the many beds. Further, angle holes involve a smaller expense in the long run.

On the North Range there are also steep dips but the prevailing dip of the formation averages about 60°, and much less in individual deposits, due to greater amounts of folding in a wider formation than on the South Range, and cross-folding. In flatter deposits vertical drilling is proper, but its application does not bar angle-hole drilling from all other places, nor even make it undesirable. Mr. Glass failed to make even these few distinctions and overlooked the relative amounts of exploration areas applicable to different drilling methods.

His statement that "the orebodies frequently contain vugs and seams of pulverulent disintegrated quartz" requires modification; for it applies only to parts of the North Range and not at all to the South Range. His main point as to this material is its contamination of drill samples, but he overemphasizes this feature because he ignores the fact that this material is absent in most places in the district, being purely local. Further, since the drillers have learned how to explore such ground, this powdery chert has been causing them but little trouble. I know of properties on which even vertical churn-drill holes had trouble in such ground.

Mr. Glass should not condemn diamond drilling *in toto*. Hard seams, generally the lower-grade ores, must be diamond drilled. If diamond drilling is otherwise objectionable, it should be used only for hard seams. Too often the drill runner continues with the diamonds after the hard seam is cut, because of the ease of the drill operation, regardless of the difference resulting later in the chemistry.

I fully recognize the fact that some angle holes have had difficulty in treacherous ground, but so have vertical holes, churn or diamond, and there have been more of the vertical than the angle holes in trouble.

CARL ZAPFFE.

Brainerd, Minn., July 17, 1914.

Editorials

Mine Accident Prevention

There is in the United States Senate at the present time a legislative situation which, from the standpoint of the mine operators, needs attention. If strong men from the Western mining states would address personal letters to their Senators on this subject, undoubtedly much good would be accomplished. The situation is as follows:

Last March there passed the House a bill (H. R. 10,735) creating a new safety labor bureau under the Secretary of Labor (W. B. Wilson), the language of which is such that that bureau can take over practically all of the safety work of the Bureau of Mines in relation to the mining, metallurgical and other mineral industries. It was not expected that this bill would be reported favorably by the Senate Committee on Education and Labor, but it was recently reported favorably, and is now on the Senate calendar for final passage, and if it passes the Senate will undoubtedly become a law. What makes the matter still more serious is the fact that into the bill making this year's regular appropriations for the Bureau of Mines, the following clause was introduced just before its final passage, viz:

"Nor shall any part thereof (of the \$100,000 appropriation for metal-mining work) be used for work authorized or required by law to be done by any other branch of the public service."

This item in the appropriation act, together with the broad general inclusive wording of the act establishing the new Bureau of Labor Safety, taken together, would make it impossible for the Bureau of Mines to hold the safety work in metal mines and metallurgical works; and the result would be that all that work would soon be turned over to a bureau which is not interested broadly in the mining industry, but only in labor matters.

If the men of the mining industry feel that they would like to cooperate in holding this safety work of the mining, metallurgical and mineral industries in the Bureau of Mines, they can contribute materially toward the accomplishment of this purpose by writing individual letters to the senators from the Western mining states, stating to these senators that they deem it wise that this work should remain with the Bureau of Mines, and that if the Bureau of Labor Safety bill passes, it should pass with an amendment that will insure the continuance of such work in the Bureau of Mines.

The most important work of the Bureau of Mines up to this time has been in its study of safety questions. Let it be noted that all that the Bureau of Mines, or any other Washington bureau, can accomplish is educational results. The actual enforcement of safety rules is a matter for the individual states and will remain so until there is a change in the Federal constitution. The function of the Bureau of Mines is to furnish technical data that will be a guide to the several states in enacting their legislation. In the studies of the staff of the bureau, there are continually being developed questions of

technical practice respecting which existing knowledge is found to be inadequate. In such cases it is the duty of the bureau to fill the gap, and as rapidly as possible it is doing so. To deprive the Bureau of Mines from attending to such studies and to transfer them to another bureau would make a mess of things.

The advocates of H. R. bill 10,735 apparently think that the measures to be taken to promote safety in mining are purely the formulation and enactment of such rules as the men employed in mines may think proper. They are wrong. To be right it would have to be assumed that the drill runners, muckers, etc., who work underground in the mines know more than the engineers who direct them. We may say authoritatively that a committee of engineers of the Bureau of Mines, which has been studying this problem for many years, has found itself constantly baffled by the imperfection of knowledge respecting many important branches of its subject. The fact is that modern methods of mining have introduced many new conditions, leading to new hazards, the nature of which is not yet fully understood by anybody. The Bureau of Mines is studying these and while it is doing so it should be let alone.

✱

Henry Pauly

The U. S. Commission on Industrial Relations, which is touring the country to learn the causes of industrial unrest, or more specifically the grievances of the workingmen, is hearing a lot of nonsense, but now and then something illuminating and refreshing, such as Cornelius F. Kelley, vice-president of the Anaconda Copper Mining Co., told it in Butte a few days ago. Mr. Kelley is now a learned lawyer, a brilliant executive and a polished and accomplished man of the world, but this was all of his own doing, he having begun life as a plain miner. The commission certainly should have recognized his competency as a witness.

In Seattle a few days ago, the commission appears to have had to listen to an uncommon stream of wild opinion, diluted with piffle, but it brought to light a remarkable character in the form of Henry Pauly, which made its session well worth while. We will tell the story of Henry Pauly in the words of the special correspondent of the *New York Evening Post*:

Pauly is an unskilled, itinerant laborer. He has worked in lumber camps and on railroad construction. He told of some of his experiences, which he said were typical of what the itinerant laborer faces as a regular thing. . . .

Last winter, when unemployment was at its worst in Seattle, Pauly organized the unemployed into "The Itinerants' Labor Union" or "The Hoboes' Union of America." He secured an old hospital building, for which the Central Labor Council agreed to pay the rent, and opened it up as a lodging house for the unemployed. The scheme was ridiculed and the building facetiously dubbed "The Hotel de Gink." Pauly was determined, however, in spite of opposition, that he would find a way of tiding these men over. He advertised for work. He sent squads of men out to clean up vacant lots. For others he got work at the commission houses, where they sorted potatoes and took in payment "seconds," which the men carried back to their lodgings. He sent out squads of men

to clean up butcher shops and markets, whenever he found opportunity, and took second cuts of meat in payment.

In the same way he got the bakeries to supply him with stale bread. Where an old building was being torn down, he got an opportunity to cart off the lumber that was not usable. In this way he supplied the house with fuel during the winter. As soon as it was possible, he began to get contracts for clearing stump land. People said that the unemployed did not want work. Pauly sent a gang of men out to clear some land, who worked more than a month in the rainy season, absolutely without shelter. Pauly would not admit to the place any man who was unwilling to work, and yet he cared for more than 2000 men during the winter.

Pauly has visions now of getting his men permanently on to the land. He hopes to get a contract for clearing land, where plots of land may be taken in payment. "That's the thing that will settle this employment question," said Pauly, "and settle it for all time."

We take off our hat to Henry Pauly and wish him more power to his elbow. May his field of usefulness be broadened and may he be honored as a constructive citizen who has set an example.

Successful Failures

It is a well recognized fact that one learns as much or more through failures as through successes. In spite of the thousands of mistakes that are being made every day in the engineering profession, we hear little or nothing of them, and consequently lose wonderful opportunities to acquire valuable information. It is an easy matter to make mistakes, but it is by no means easy to derive the maximum benefit from them. An engineering mistake which will cost thousands of dollars may easily be made by a careless person, whose first impulse is to cover up both the error and its results, thereby hiding from himself and the world at large a lesson from which much benefit might have been derived.

Large sums of money have been sunk in underground exploration and so called development work. It is easy to bury money and mistakes underground where no one can ever find them. Most of the big mistakes have been effectually covered up, so that even if the maker learned a profitable lesson through them, the world at large lost it. The same is true in metallurgical processes, although these are so open and the processes are so clearly defined that a disastrous mistake will be discovered and announced unless a combination of all the wise ones can be maintained to promote secrecy. The latter contingency is by no means unknown, and contemporary operators may easily remember a great error in mill operations which concerned not only one plant, but a large number of them operating in the same locality, and which wound up in a large loss of money and great disappointment to those financially interested in the properties. A union of the operators succeeded in keeping the basis of the loss secret, so that although they profited by the mistake themselves, the rest of the world did not, and still might, at any moment, fall into the same error.

It takes a large amount of moral courage to make public the reason and results of a mistake in engineering, and we may hardly expect engineers in general to show it, although it would be the most informing and conclusive method of information open to operators of the present day. If some famous engineer would describe a serious mistake he had made, giving the facts, the reasons leading up to the step, and its eventual results, he would deserve a monument to his bravery; and in addition, he would have contributed more to the successful solving of future problems than all the men who write only of suc-

cesses, saying nothing of the failures that naturally occur in everybody's career. It would be, in fact, a successful failure. We have no great hope that the desire for this sort of information will be satisfied, but we have the desire, nevertheless.

Gold Production in 1914

At the present time, when there is an extraordinary demand for gold throughout the commercial world, it is of interest to consider what new supplies are likely to be available. The accompanying table shows the production for the first half of 1914 in those countries from which accurate figures are attainable.

	1913	1914	Changes
Transvaal	\$95,917,502	\$84,475,127	D. \$11,442,575
Rhodesia	6,950,549	8,222,877	I. 2,272,328
West Africa	4,216,577	4,048,261	D. 168,316
Total Africa	\$107,084,628	\$96,746,265	D. \$10,338,363
Australasia	25,027,758	24,581,274	D. 446,484
British India	5,943,845	6,108,171	I. 164,326
Total	\$138,056,231	\$127,435,710	D. \$10,620,521

These countries from which we have regular and reliable monthly returns produced in 1913 about 58% of the entire gold output of the world. For the half year their total loss has been 7.7%, which was chiefly due to the heavy decrease in the Transvaal. For the remaining gold producers, which furnish no periodical returns, such indications as we have do not point to any considerable changes except in Mexico, where the output must have been light. Allowing for this and also taking into account the fact that no new producing districts of any importance have been opened during the year, it appears probable that the world's output of gold in the first half of 1913 was somewhere between \$215,000,000 and \$220,000,000, probably at least \$15,000,000 less than in the first half of last year.

The prospect is that this loss will hardly be made up in the second half of the year. While none of the great producing regions—even in Russia—are directly affected by the war conditions now prevailing in Europe, there will be much indirect influence exerted. Thus in the Transvaal and Rhodesia there may be difficulties in the way of securing supplies and new machinery needed; as for instance, the supply of cyanide, to which some reference was made in our columns last week. Other reasons may be found in a diversion of men from the mining industry and the general disarrangement of business.

It appears probable therefore, so far as can now be foreseen, that the current year's gold production will be appreciably below that of its predecessor—quite possibly the smallest for several years.

A noteworthy feature of the last month has been the complete disappearance of the friction between Washington and the business interests of the country and also of the criticism that Washington by preference sought incompetent advice. The problems which heretofore have divided us have been those which economists treat in their chapters on the distribution of wealth. Since the calamity, the questions of distribution have faded into insignificance, the one great problem having become the creation and preservation of wealth.

Some of the articles that we are now publishing read rather strangely in view of recent events, which have changed all thoughts, all conditions, and have had a far-

reaching effect upon the mining industry. Of course, they were written before there was any suspicion of the catastrophe that was coming. We are confident, however, that a restoration of the conditions of civilization is coming in due course of time, and in the meanwhile it will be best for everybody in this country to continue to think about the things concerned with constructive industry that were previously engaging their attention.

BY THE WAY

The luxury of war is about the only one that will be indulged in for some time to come. Diamonds will not be so valuable as food to many people, and the South African diamond-mining companies are seeing the light. A. Reuter's agency cables from the Kimberley says: "It is officially announced that owing to the financial collapse in London, the De Beers company is closing down the local mines for the time being. The company is making arrangements for supplying all white employees with rations until operations are resumed, while steps are being taken for the immediate repatriation of the natives." Similar announcements in respect of the New Jagersfontein and the Premier diamond mines are expected.

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The decision of the directors of some of the Rand mines to postpone *sine die* the payment of dividends, has brought forth a flood of letters from stockholders, some plaintive, some abusive and some merely indicating bewilderment. One correspondent imagined that the reason for withholding dividends was the impossibility of remitting them to Continental shareholders. As a matter of fact, the chief reason, according to the London *Financial Times* is the moratorium. The directors of all the companies concerned are absolutely in the hands of their bankers, and without the consent or assistance of the latter it is obviously impossible for dividends to be paid. In some cases tens of thousands of pounds are on deposit with the banks, the necessary proportion of which was due to be transferred to current account in time for the cashing of the dividend warrants. But in the ordinary course the banks have lent out this money, and as clients claim the benefit of the moratorium to postpone repayment, the banks have obviously had to do the same thing. In other cases the gold has been sold to banks in South Africa against drafts on London which will under the moratorium not be honored until the bullion arrives in England, or until special arrangements can be made. Company directors who had been indolent enough or careless enough to leave money on deposit where it was not earning interest for shareholders, might easily be at an advantage just now over their more energetic or careful rivals in being able to render available sooner the money necessary to pay out dividends. Directors are doing their utmost to render the delay in payment as short as possible. With the banks now reopened it is quite conceivable that when the new currency arrangements are found to be working smoothly facilities may be granted for the paying of dividends.

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The following letter from our regular correspondent in Germany is interesting in several ways. It was dated

July 30, and reached us on Aug. 24. We had instructed Mr. X to go to Cologne to obtain information about a new roasting furnace of which we had received some interesting reports. Mr. X wrote: "The weather being distressingly wet and cold, forbidding any excursions, I left Clausthal-Zellerfeld yesterday at 1:08 p.m., reaching Goslar in a drenching rain at 3:26 p.m. There I took the 4:07 express train for Cologne, arriving here punctually at 10:17 p.m. This morning I proceeded to the office of the . . . gesellschaft m. b. H., and sent in my card to the manager. I was admitted into the presence of this august personage, who, on learning my business, informed me that he had no authority to impart any information about the . . . roaster for publication and that the only person who had discretion to do so was the technical manager who was just off on his summer vacation. He, himself, was only managing commercial matters and was not conversant with the technical part of the business. After some conversation, he showed me a prospectus of the roaster. I asked him if he would not let me have that, as it was evidently intended for distribution among interested persons. He replied that it was printed for private circulation and distributed confidentially only. After some hesitation, he consented, however, to let me have a copy on the promise not to publish anything that would benefit the competitors of this roaster. Contrary to German custom, he did not tell me his name, and that of his technical coordinate I did not catch as it was mumbled in a low voice."

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Will the Government Purchase Silver?

The Washington correspondent of the *Journal of Commerce* reports that the Smoot bill, directing the Secretary of the Treasury to purchase 15,000,000 oz. of silver passed the Senate Aug. 22 by a vote of 29 to 11. Senators Burton, of Ohio, Norris, of Nebraska and Weeks, of Massachusetts, protested. Senator Burton characterized it as the worst form of "special interest" legislation. As introduced the bill required the Secretary to purchase 25,000,000 oz. of the metal. The finance committee cut the amount to 15,000,000 oz.

Senators from silver-producing states insisted that the European war had made it impossible for them to sell silver abroad and that unless the Government purchased the product of the mines it would be necessary for most of them to shut down, which would affect not only the mines which produced silver but those in which lead and copper are the chief products and in which silver is a by-product.

The bill provides that the Secretary shall purchase and hold the silver bullion for the subsidiary coinage and that he shall buy at a price not exceeding the average price at which silver sold between Jan. 15 and July 15 of the present year.

At a conference between Secretary McAdoo and Senator Smoot of Utah, Mr. Smoot learned that the Dutch government had applied to the Treasury Department about the purchase of a large quantity of silver bullion. Secretary McAdoo referred the Dutch government to the American Smelting & Refining Co. The bill has yet to go to the House.

PERSONALS

G. A. Joslin, of Los Angeles, is making examinations of mining property in San Bernardino County, Calif.

C. R. Corning has been in Chile. He expects to arrive home in New York in about two weeks from this time.

Henry H. Armstead has returned to New York from Mexico, where he has been on a business trip for six weeks.

Ludwig Vogelstein, of L. Vogelstein & Co., who has been for some weeks past in Germany, has returned to New York by way of England and Canada.

D. L. H. Forbes, Toronto, Ont., has been appointed chief construction engineer of the Chile Exploration Co. After Sept. 1 his address will be at Chuquicamata, Chile.

Ralph Arnold, of Los Angeles, Calif., has been examining lands in the Flathead country, southeast Kootenay, owned by a British Columbia company, and believed to be oil bearing.

Prof. Alexander MacPhail, of the Queen's School of Mining, Kingston, who is Major in command of the Queens Engineering Corps, has volunteered for service in the European war.

C. S. Verrill, of Vancouver, B. C., has been assisting A. G. Larson, who was employed by the Department of Mines of British Columbia to make an investigation of the ore production probabilities of Franklin camp.

Dr. C. W. Drysdale, of the Geological Survey of Canada, has completed his work in Rossland camp, British Columbia, and has gone to Ymir, in Nelson mining division of West Kootenay, to study the ore deposits of that camp.

Sir William Mackenzie, president of the Canadian Northern Ry., has returned to Toronto from England, where he was arranging for a loan to be guaranteed by the Canadian Government, negotiations being terminated by the outbreak of the war.

A. B. Emery, recently at Zacatecas, Mexico, has been appointed general manager of the Messina (Transvaal) Development Co., Ltd., and will have charge of the copper mines at Messina, Northern Transvaal. He is now on his way to his new charge.

Frank E. Pearce, formerly of Baker City, Ore., who was last year in charge of development work at the Inland Empire mine, in the western part of Trail Creek mining division, B. C., is now directing development work on the Pingree, in Nelson division.

N. H. Emmons, 2d, has recently been examining mines in Taos County, N. M., for some Seattle people. Mr. Emmons, who was until recently Superintendent of Mines of the North Butte Mining Co., is visiting his brother, Dr. Arthur B. Emmons, 2d, at Knollwood, Dover, Mass.

J. D. MacKenzie, of the Geological Survey of Canada, and Prof. V. Dolmage, of Columbian College, New Westminster, B. C., are reported to have been injured by an explosion of gas at an old coal prospect at the southern end of Graham Island of the Queen Charlotte group, British Columbia. Prof. Dolmage was spending a vacation with Mr. MacKenzie, who was studying the coal deposits of Graham Island.

Thomas Graham, of Victoria, chief inspector of mines for British Columbia, while attending the mine-rescue and first-aid demonstration held at Seattle, Wash., on July 22 and 23, under the auspices of the United States Bureau of Mines, acted as judge of the contests in the mine-rescue events. At the request of the committee, E. Jacobs, who was also a visitor from Victoria, was official scorer throughout the two days' meeting, which was attended by more than 50 competitors in the various events and numerous friends from different parts of the state.

SOCIETIES

American Peat Society—From 75 to 90 delegates met at Duluth, Minn., Aug. 20, for a three-day convention. In the absence of President George N. Hoff, New York, Vice-President Carl G. Kleinstuck presided. A number of delegates from various European countries were scheduled for addresses, but none was able to be present. A large display of peat and peat products was assembled in the rooms of the Duluth Commercial Club, where the convention met.

On Aug. 21, as guests of the railroads, the delegates made

a trip over the Mesabi iron range by special train, at the same time inspecting various peat deposits in the vicinity. In the course of an address, the vice-president of the society, Mr. Kleinstuck, of Kalamazoo, Mich., stated that the German Government has long recognized the value of peat in connection with the tempering of steel, and that the Krupp use nothing but peat coke for tempering armor plate. Prof. Peter Christiansen, of the University of Minnesota, spoke on "The Possibilities of Peat in the Beneficiation and Smelting of Iron Ores," wherein he favored locating the power plant at the peat deposit, generating electrical current for transmission and thereby eliminating the transportation cost. He discussed the recently perfected process of burning peat in powdered form, as it is now being used for locomotive firing in Sweden, and stated that such material is easily adaptable to the firing of cylindrical furnaces used for drying, roasting or calcining. He stated that if peat could be made into a coke of sufficient hardness, there appeared to be no reason why the composition of such coke would preclude its use for smelting purposes. In such an event, the Minnesota iron ranges would have their own fuel supply right at their door, in many instances even on their own property. Much time was given to papers relating to briquetting problems and to the agricultural possibilities of peat bogs.

TRADE CATALOGS

National Transit Co., Oil City Penn., Bulletin No. 10 and 11. 16 pp. Illus. 9x6 inches.

E. E. White, Ishpeming, Mich. Price list of the Maas Patent Drill Hole Compass.

Electric Weighing Co., New York, N. Y., Bulletin No. 8. Messiter Conveyor Scales. 18 pp. Ills. 9x6 in.

Titan Storage Battery Co., Newark, New Jersey. Catalog Titan Storage Batteries. 32 pp. Illus. 11x8 1/4 inches.

The John Simmons Co., 110 Center St., New York, Catalog. The Klein Boiler Circulator "Kebec." 8 pp. Illus. 6x3 inches.

The National Tube Co., Pittsburgh, Penn. "National" Bulletin No. 13A. Second Edition, 12 pp. Illus., 11x8 inches.

Traylor Engineering & Mfg. Co., Allentown, Penn. Bulletin. Anaconda slime concentrator. 16 pp., Illus., 7x9 1/2 inches.

Chicago Pneumatic Tool Co., Chicago, Ill., Bull. No. 34 W. Class A-O "Giant." Fuel Oil Engines. 16 pp. Illus. 9x6 inches.

The American Rolling Mill, Middletown, Ohio, Catalog. Defeating Rust. The Story of Armco Iron. 44 pp. Illus. 9x6 inches.

The Marion Steam Shovel Co., Marion, Ohio. Catalog No. 91. "Stripping Coal with Economy & Speed." 40 pp., Illus., 5x7 inches.

Sprague Electric Works, 527-31 W. 34th St., New York. Bulletin No. 48901. Electric winches and winding drums. 16 pp., Illus., 8x10 1/2 inches.

Colorado Iron Works Co., Denver, Colorado, Catalog 12-P. Some Details as to Smelting Practice and Equipments, 160 pp., Illus., 9x6 inches.

Chicago Pneumatic Tool Co., Chicago, Ill. Bulletin No. 34-N. Class N steam and power driven inclosed compressors, 16 pp., Illus., 6x9 inches.

The Denver Engineering Works, Denver, Colo., Bulletin 1063, Isbell Concentrator, 10 pp. Illus. 11x8 in. Bulletin 1069, Richards Pulsator Riffle, 8 pp. Illus. 11x8 inches.

The Electric Storage Battery Co., Philadelphia, Penn. Bulletin No. 146. The "Ironclad-Exide" Battery for Storage Battery Locomotives. 18 pp., Illus., 10 1/2 x 8 inches.

National Tube Co., Frick Bldg., Pittsburgh, Penn. "National" Bulletin No. 10C. 24 pp. Illus. 11x8 1/2 in. This is the fourth edition of bulletin 10 and contains four papers on the subject of corrosion.

INDUSTRIAL NEWS

The George D. Whitcomb Co. has taken over the storage battery locomotive business of the C. K. Davis Manufacturing Co. of Detroit.

The John Simmons Co., 110 Center St., New York, has taken over the manufacturing and selling rights of the Klein Boiler Circulator "Kebec" and has established a new department under the personal direction of Paul M. Klein.

The new illustrated catalog, No. 214, of the Hess Flume Co., 2166 15th St., Denver, describes the flumes, meters, gates, culverts, pipe, valves, etc., handled by this company. Illustrations of many flume installations are shown, and descriptions of approved types of wood and steel substructure, side hill construction and ditch lining are given. The book is attractive and instructive.

Allis-Chalmers Mfg. Co., Milwaukee, Wisconsin. Catalogo ilustrado Nu. 100, 180 paginas, 10 1/2 x 8 pulgadas; catalogo ilustrado, Nu. 103, 128 paginas, 10 1/2 x 8 pulgadas. El Nu. 100 contiene descripciones de maquinaria para beneficiar metales como quebradoras, trituradores para muestras, elevadores, tambores o cribas giratorias, sacamuestras, baterias de mazos, concentra doras y aparato para la cyanuracion, incluyendo remoladores tubulares, aparato por sistema "Dorr," tanques agitadores, sistema "Parral," filtros-prensas, y notas de todas piezas refacciones. El Nu. 103, trata de toda maquinaria y accesorios para calcinar, fundir y convertir metales, especialmente minerales de plomo y de cobre.

INDUSTRIAL NEWS

Corrigan, McKinney & Co., of Cleveland, Ohio, have let a contract for building two additional blast furnaces to the Vanity Iron & Steel Works Co., of Cleveland.

The Terry Steam Turbine Co. announces that it has appointed Fidanque Bros. & Sons, of New York and Panama, with main office at 15 Whitehall St., New York, as its representatives for the Republic of Panama and the Canal Zone. On Aug. 1 its Cleveland office was moved to 503 Union Building.

The Westinghouse Electric & Manufacturing Co. reports the receipt of the orders from mining companies for the following machinery: An aggregate of 2715 hp. of motors; three 8-ton and one 4 1/2-ton locomotives; one 75-kw. motor-generator set; 1756 kv.-a. of turbo-generators; four switchboards; 3726 kv.-a. of transformers; two 16-kw. motor-generator sets, and one 1001 kv.-a. waterwheel generator.

The Lyons Atlas Co., of Indianapolis, Ind., has recently completed and shipped the largest Diesel engine constructed to date in this country. This is a four-cylinder engine, 21-in. bore by 30-in. stroke, of the vertical, four-cycle type, rated at 600 brake horse power with an overload capacity of 15%, or 690 horse power maximum. It was sold to the Hawaiian Commercial & Sugar Co., and is intended to supersede one of its steam plants for irrigation purposes, to be direct-connected to a two-stage turbine pump of 15,000,000 gal. capacity at 200 ft. head. The conditions covering the acceptance of the engine were: The engine must operate continually 710 hr. out of each 720 hr. per month at rated load, using the ordinary 14° to 18° asphaltum-base California fuel oil, which is the only grade available on the Islands. The engine was given a preliminary, continuous run of 48 hr. with eastern paraffin-base fuel, after which it was subjected to a 144-hr. continuous run at full load with California oil. At the completion of this run the combustion chambers were examined, and as there was no evidence of deposit on the heads, valves or pistons, the engine was accepted.

The Traylor Engineering & Manufacturing Co., of Allentown, Penn., has recently furnished for J. Buckland a large slag-crushing plant having a capacity of 300 tons per hour. This plant will crush iron-blast furnace slag from the Bethlehem Steel Co.'s dump, and will supply crushed slag for ballast and concrete work, in place of the customary stone. One of the special features of the plant is an extra heavy 54x36-in. set of rolls, having corrugated faces. The slag will be loaded by steam shovels and taken to the crushing plant in special cars. The Traylor company has also shipped a set of heavy-duty "AA" 42x16-in. crushing rolls and accessories to the Royal Basin Mining Co., of Montana; a 60x30-in. all-steel jaw crusher, three sets of 42x18-in. "AA" rolls, screens, conveyors, etc., for the St. Louis Smelting & Refining Co.; a 60x30-in. all-steel crusher, 48-in. and 60-in. trommels, 20 ft. long, and miscellaneous equipment for Mine La Motte; a gyratory crusher for the Piedmont Construction Co.; Blake crushers and "A" rolls for the Park City Milling Co.; rolls for the Honduras Trading Co.; a 1600-ton crushing plant for the Quebec Brick Co.; a 60-in. Blake crusher and overhead cableway for the Amalgamated Asbestos Corporation; a set of crushing rolls for the Sulphur Mining & Railroad Co.; also an 84x60-in. Blake crusher for the Johns-Manville Co.; this is one of the largest crushers ever built and weighs over 500,000 lb.; it will be used in the Quebec asbestos quarries.

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.

ARSENIC AND ANTIMONY—Extraction of Arsenic or Antimony from Ores Containing the Same. Harold Allman Lewis and Frederick Glyn Price, Cobalt, Ont.; said Price assignor to said Lewis, Oruro, Bolivia. (U. S. No. 1,104,810; July 28, 1914.)

ASSAY BALANCES—Base for Assay Balances and the Like. Wilfrid Heusser, Salt Lake City, Utah. (U. S. No. 1,104,969; July 28, 1914.)

BALANCE. Wilfred Heusser, Salt Lake City, Utah. (U. S. No. 1,104,892; July 28, 1914.)

BLAST FURNACES—Device for Utilizing the Off Gases from Blast Furnaces for Preheating the Blast. Joseph Etienne Prégardien, Cologne, Germany, assignor to Fritz Neumann, Aachen, Germany. (U. S. No. 1,105,158; July 28, 1914.)

CLASSIFIER—Hydraulic Classifier for Separating Sand and Slime. Wilton E. Darrow, Sutter Creek, Calif. (U. S. No. 1,106,630; Aug. 11, 1914.)

CONCENTRATING TABLE. Edmund B. Kirby, St. Louis, Mo. (U. S. No. 1,105,912; Aug. 4, 1914.)

CONCENTRATOR—Dry Concentrator. Lewis A. W. Johnson, Los Angeles, Calif. (U. S. No. 1,105,977; Aug. 4, 1914.)

CONCENTRATORS—Process of Operating Ore Concentrating Tables. Edmund B. Kirby, St. Louis, Mo. (U. S. No. 1,105,799; Aug. 4, 1914.)

CRUSHER—Gyratory Crusher. John McInroe, Chicago Heights, Ill., assignor to Chalmers & Williams, Inc., Chicago Heights, Ill. (U. S. No. 1,106,333; Aug. 4, 1914.)

CUPROUS CHLORIDE—Process of Reducing Cuprous Chloride. Frederick Laist, Anaconda, Mont. (U. S. No. 1,104,907; July 28, 1914.)

CYANIDING—Process and Apparatus for the Extraction of Pregnant Cyanide Solutions from Pulp. Edson S. Pettis, San Francisco, Calif. (U. S. No. 1,106,836; Aug. 11, 1914.)

DRILL—Percussive Drill. John George Leyner, Denver, Col. (U. S. No. 1,106,332; Aug. 4, 1914.)

ELECTRIC FURNACE. Ernesto Stassano, Turin, Italy. (U. S. No. 1,105,859; Aug. 4, 1914.)

ELECTRIC-FURNACE PROCESS AND ELECTRIC FURNACE. Carl Hering, Philadelphia, Penn. (U. S. No. 1,105,656; Aug. 4, 1914.)

GAS FROM OIL, Process of Making. William A. Hall, New York, N. Y. (U. S. No. 1,105,772; Aug. 4, 1914.)

GRAPHITE—Improvements in and Relating to the Treatment of Graphites. E. N. Laine, Paris, France. (Brit. No. 5798, of 1914.)

HOISTING—Balancing Means for Hoisting Apparatus. Letson Ballet, Tonopah, Nev. (U. S. No. 1,107,191; Aug. 11, 1914.)

LAMP—Acetylene Lamp. Meyer Stein, Springfield, Ill. (U. S. No. 1,106,062; Aug. 4, 1914.)

LEACHING—Process of Ore Treatment. Cyrus Robinson, Mount Vernon, N. Y., assignor to Metallurgical Engineering & Process Corporation, New York. (U. S. No. 1,105,102; July 28, 1914.)

LEAD REFINING—Apparatus for Refining and Desilverizing Lead. William Thum, Hammond, Ind. (U. S. No. 1,106,480; Aug. 11, 1914.)

MAGNETIC SEPARATOR. Harry Johan Hjalmar Nathorst, Malmberget, Sweden. (U. S. No. 1,105,293; July 28, 1914.)

MINE-CAR LUBRICATION. Jasper A. McCaskell, Salt Lake City, Utah. (U. S. No. 1,105,363; July 28, 1914.)

ORE REDUCTION—Reduction of Ores by Means of Peat. Per Anderson, Arvika, and Erik E. son Odelstierna, Stockholm, Sweden. (U. S. No. 1,105,870; Aug. 4, 1914.)

ORE TREATMENT—Process of Treating Ores. Nils C. Christensen, Jr., and Theodore P. Holt, Salt Lake City, Utah; said Christensen assignor to George H. Dern, Salt Lake City, Utah. (U. S. No. 1,107,240; Aug. 11, 1914.)

PHOSPHATES—Process of Rendering Soluble Insoluble Phosphates. Walter S. Landis, Niagara Falls, Ontario, Canada, assignor to American Cyanamid Co., Nashville, Tenn. (U. S. No. 1,103,059; July 14, 1914.)

SEPARATION—Apparatus for Recovering Valuable Constituents from Ores. Frederick H. Prentiss, San Francisco, Calif., assignor of one-half to Leda B. Prentiss, San Francisco, Calif., and one-half to Robert C. Lane, Berkeley, Calif. (U. S. No. 1,104,132; July 21, 1914.)

SULPHURIC ACID—Manufacture of Sulphuric Acid. Utley Wedge, Ardmore, Penn. (U. S. No. 1,104,590; July 21, 1914; and No. 1,106,999; Aug. 11, 1914.)

TITANIUM—Metallurgical Method. Auguste J. Rossi, Niagara Falls, N. Y., assignor to The Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,104,317; July 21, 1914.)

WASHING AND COLLECTING APPARATUS—Robert Hazlehurst Wright, Nashville, Tenn., assignor to Charleston S. C. Mining & Manufacturing Co., Mount Pleasant, Tenn. (U. S. No. 1,103,390; July 14, 1914.)

ZINC—Condenser for Zinc Vapors. Moses Appel, Johnstown, Penn. (U. S. No. 1,103,123; July 14, 1914.)

ZINC—Improvements in or Relating to the Separation of Zinc Blende and other Metalliferous Constituents from Ore Concentrates and Slimes by Flotation or Granulation. E. J. Horwood, Broken Hill, N. S. W. (Brit. No. 28,604)

ZINC—Process and Apparatus for the Extraction of Metallic Zinc from Its Ores. E. F. Cote and P. R. Pierron, Lyons, France. (Brit. No. 17,874 of 1913.)

Editorial Correspondence

SAN FRANCISCO—Aug. 20

Plan of Reorganization of Natomas Consolidated of California has become operative, according to announcement of the reorganization committee at San Francisco, on Aug. 17. More than 85% of the first-mortgage bonds have been deposited. It is estimated by Frank B. Anderson, chairman of the committee, that the amount will reach 90%, as a number of holders have requested further time for depositing, which has been granted. Ninety per cent. is equal to \$12,712,500. Of the second-mortgage bonds, 90% have been deposited, amounting to \$2,224,000. There are 163,390 shares of stock outstanding, of which 144,175½ have been deposited. The plan contemplates the incorporation of a California company, with following capitalization: Non-cumulative preference shares (non-assessable) 6%, \$7,250,000; common stock (non-assessable), \$9,250,000; 20-year 6% first-mortgage bonds, \$16,500,000. For the purpose of raising new money required, the California company will create 5-year 6% notes in the amount of \$3,000,000, secured by California company bonds and such irrigation and reclamation bonds as the California company may own or acquire. Natomas Syndicate will agree to subscribe for these notes at 90%, and receive as consideration 312,000 fully paid shares of the new English company to be formed with \$600,000 capital for the purpose of acquiring and holding the shares of common stock of the California company. After the 5-year notes have been redeemed, 80% of the net proceeds of all land sales will be applied to redemption of bonds. Provision will be made for the exchange of existing shares and securities of the Natomas Consolidated of California.

A Reduction in the Price of Crude Oil of 5c. has been made by the Standard Oil Co. to the producers, for all grades except fuel oil. Oil in Ventura field is cut 10c. This price does not affect oil already under contract, but will apply to all renewals of contracts and to oil sold in the open market. It is estimated that at present there are shut in a sufficient number of wells in several of the fields of the state to increase the daily output of the state by 20,000 bbl. The new schedule in the Midway-Sunset field varies from 40 to 65c. per bbl. for 14 to 31 gravity oil; Coalinga field, 40 to 75c. for 14 to 35 gravity oil; Lost Hill and Belridge, 42 to 75c. for 21 to 35 gravity oil; Ventura County, 55 to 65c. for 22 to 32 gravity oil; Kern River field, 40c. minimum for 14 gravity oil; Whittier-Fullerton, 50 to 70c. for 22 to 28 gravity oil.

Dividends of Two Per Cent., recently declared by the Union Oil Co. of California, has been recalled and the contract for sale of \$15,000,000 of treasury stock to the British Union Oil Co. has been extended to Apr. 1, 1915. A special meeting of the boards of directors of Union Oil, Union Provident and United Petroleum, on Aug. 11, adopted resolutions setting forth as reasons for recalling dividend and extending contract, the demoralization of international business by the European war; and stating that about 20% of the business of Union Oil is foreign trade, which, in all probability, will be liable to serious interruptions for several months. The statement further declares that the position of the company is exceptionally strong. That the company has approximately \$10,000,000 of quick assets, of which more than \$1,000,000 is cash on hand and in banks against floating liabilities of about \$3,500,000.

Gypsum Locations on Land Containing Oil are made valid by a decision of the Department of the Interior in the case of Boust vs. Jameson, on appeal from the General Land Office. The case involved seven gypsum locations near Taft, Kern County. The local land office decided in favor of Jameson, who claimed the land under gypsum locations. The General Land Office reversed the decision on the ground that gypsum was not shown either in quality or quantity to entitle for the gypsum contained, and further that it was the evident purpose of the claimant to get title for the oil contained in the land. This ruling reverses the policy followed by the commissioner for several years and conforms to the policy of the Department of the Interior under the Ballinger regime that location on land shown to contain gypsum in quality and quantity is not invalid because of possible oil value of the land.

Reopening of San Francisco Stock Exchange, mining and oil department, on Aug. 19, after being closed for 20 days, was confined to Comstocks, and but little business was transacted. Only a few of the leading stocks received attention and prices were at low level. Favorable advices came from Belcher, Union and other mines, but had little effect on prices of shares. Prominent oil shares sustained losses. Delinquencies on all Comstock assessments being collected have been postponed. Similar action has been taken by many southern Nevada companies, which sent out calls for funds shortly before the exchange closed.

BUTTE—Aug. 20

The Butte miners are still far apart in any effort to harmonize local differences, and the attempt of the Western Federation of Miners to bring the rebels back into the federation fold will probably fail. A committee from the federation came to Butte to inaugurate a reign of harmony, and began by procuring the resignations of all the old officers of the local union and then invited the rebels to come back and help to elect a new set of officers. The reply generally was that unless President Moyer was absolutely and permanently eliminated from the Western Federation the seceders would not return, and as Moyer seems determined to stick, there will be no peace movement in Butte. The new Butte Mine Workers' Union has not yet made definite demands on the mining companies, although at the last meeting of the union a resolution was seriously considered to ask the companies to reopen all its mines and give employment to the several thousand miners who were laid off, and to pay them half in cash and half in scrip, as was being done by the Butte-Duluth Co., but after discussion the majority members of the union voted it down because, as they thought, it would set a bad precedent and would look as though the union was asking a favor of the companies. What the new union did practically decide on, although no definite action was taken, was to make a move for recognition of the union on the part of the Anaconda company. It was proposed to go to the Moonlight mine, at sometime within a month, and demand that no miner be allowed to work unless he wore the white button of the new union. When that demand is made it will put up to the companies squarely the question whether they will recognize the new union or the Western Federation union. In view of the fact that the companies are not anxious to operate their mines at present, such a demand by the new union might come opportunely for the companies and inopportunely for the union.

MARQUETTE—Aug. 21

Predictions that the war in Europe would be beneficial to the American iron and steel trade, this on the theory that a monopoly of the world's markets would be lodged with manufacturers in this country, have as yet had no fruition in the Lake Superior mining region. The demand for ore has shown no increase traceable to business originating as a result of the clash of the battling nations. On the contrary, due to added unsettlement in trade circles, a development for which the European conflict is held responsible, some producers with large stockpiles on hand have scaled down outputs still further. At the head of Lake Superior all construction work at the Minnesota plant of the United States Steel Corporation has been suspended for an indefinite period, the shutdown throwing 600 men out of work. It is possible, perhaps probable, there will be a more liberal use of American manganese iron ores, of which commodity the only important supplies in the Lake Superior country are in the Cuyuna range; it is possible also that the demand for the bessemer and nonbessemer product will expand more than ordinarily would be the case, but the immediate effect of the mighty martial struggle across the Atlantic cannot be said to be helpful.

Pickands, Mather & Co. of Cleveland is making an energetic search for ore in the Felch Mountain district, north-east of Iron Mountain, Menominee range. A diamond drill is running day and night in the vicinity of the Calumet mine, now inactive. The exploration in the field heretofore has been shallow. Deep holes will now be bored.

The New Process Metals Co., which is erecting at Marquette a John T. Jones step-process furnace, a plant designed to treat iron ores of low grade and make of them a valuable commodity, expects to have the stack in blast by the middle of September or the first of October at the latest. Practically all of the heavy machinery is in position. The installation of the smaller equipment is going forward rapidly. The stack is finished. It is 60 ft. from the base to the top; the heavy brickwork at the base is 24 ft. high. The steel part of the stack is lined with fire brick. The part of the plant that particularly attracts attention is the large preheating tube, 6 ft. in diameter and 60 ft. long, in which the electro-magnetic process perfected by Mr. Jones takes place. The tube rests on concrete pillars. It will be rotated by electrically-driven machinery. The tube will be lined with brick of special quality. At the lower end of the tube, which is inclined a few degrees from the horizontal, is the upright reducing furnace, 35 ft. high and approximately 12 ft. in diameter, narrowing toward the top. This also will be lined with brick of special quality. No blowing machine or artificial draft will be required. Wood will be used in the metallizing process. Following the treating of the ore in the preheating tube and the reducing furnace, it will be conveyed to a crusher and thence to "jigs" which will remove from the metallized product the charcoal, silica and other impurities.

HOUGHTON—Aug. 26

Further exploratory operations at the Wyandot continue to show promising results. While the work is carried forward under handicap and only in a most limited way, the lateral openings are in 45 ft. and a total of 100 ft. of openings now is made in this new lode. The results compare favorably with the showing when first opened. In fact, there is no disguising the fact that in all of the exploration work which the Wyandot has carried forward at different times the present showing is unquestionably the most promising. The formation has been exposed in three different places, at the seventh, eighth and ninth levels. In the upper level there was no copper at all. In the eighth it showed in commercial quantities and in the ninth it is very rich. There is no identity to the lode yet. It differs in every important detail from all other lodes in this district. It is an amygdaloidal formation, but full of crystals. In addition to showing a leached condition, it showed a bleached result of igneous action, and the shot copper occurs in crystals, something very unusual in any of the lodes of the Michigan district. In fact the lode is almost white. The general characteristics are healthy. The lode is reasonably wide with an even distribution of the copper. Wyandot's treasury is in reasonably good condition and operating expenses are small under existing conditions. The management would like to explore the present operating lode at greater depth and plans have been made with that in view, but such a move would be costly and as long as the lateral openings continue to show such good results, the openings in both directions from the winze will be pushed.

The Double Tax on Mineral Products of Michigan, copper, iron and coal, will have to be fought out before the electorate of the state in the near future. Every fight on the tonnage-tax issue, as brought up in this state to date, has been confined to the legislature and the injustice of the proposition has been shown to the members of that body, with the result that no proposed tonnage tax ever has reached the governor. But now the issue goes before the whole people of the state by the action of the Michigan state grange, the organization of farmers, who have invoked the initiative for this proposed legislation.

Operating Costs at the Wolverine for July were under 8c. per lb. In June the costs were 8.13c. per lb. and in May just under 9c. This gradual reduction has come about through managerial economies and cutting off of expenses, which were brought on by the strike. At this writing the Wolverine continues to operate full tilt.

The Shaft at the Keweenaw is down 700 ft. and the rock that is being hoisted continues to show good values in copper. Machinery from the Mandan shafts is being installed to do the hoisting. Additional drills were put to work this week. A force of carpenters is at work renovating and repairing the residences for employees. The management has funds enough to continue operations at the present rate during the winter.

SILVER CITY—Aug. 3

Preparations for New Mexico's Mineral Exhibit at the San Diego Exposition in 1915 are under way. The exhibit promises to be the largest display of its kind ever shown by the state. Fayette A. Jones, president of the State School of Mines at Socorro, has charge of the assembling of the minerals and is touring the state in the interest of the exhibition.

JOPLIN—Aug. 22

Zinc Smelters Obtained Much Zinc-Carbonate Ore from Leadville during 1911, 1912 and 1913, and some even from California and Nevada, which was used in a mixed charge with blende ores, especially in the zinc smelters in the Kansas gas belt, where gas was getting scarce and roasting was avoided as far as possible. The fact that the Colorado Leadville zinc-oxide plant is now buying a very large part of the carbonate output of the Leadville camp, even taking as low as 14% zinc ores, is stated to be one of the reasons why zinc silicate ores in the Joplin district have been so greatly in demand the last six months. So great has been this demand as compared with that for blende that the relative prices for zinc silicate ores have been much higher than blende and have stimulated prospecting for the ore throughout the camps south of Joplin. Among the tracts prospected were the E. A. Rose land, where a prospecting campaign by Baldry & Co. has resulted in the opening of a large deposit of calamine. Two shafts are now being sunk and some very excellent ore found in one of them. East of this land, the same company has been opening up some promising calamine following the mining of lead ground.

Grigg & Co. have been prospecting farther east and south all spring and summer, and have sunk a large number of shafts into ore, the ore being found practically at the water level. Following this campaign, it will be possible for a large output to be made when a general pumping station is put in. The prospecting continues southward to Tipton Ford, where a number of prospects have been opened up on the Goodrich land, there being zinc carbonate and "dry bone" or lead carbonate. Buxton & Etter have just taken a lease on a part of this land and are now engaged in putting a tunnel into a hill to tap the ore deposit, which has already been developed by other prospectors in the same vicinity. At least five producers are now turning out ore from this tract.

Frank B. Wilcox and Associates have reopened the old White Oak mine at Tipton Ford and are said to be turning out a good showing of ore after a long period of development. Within a few weeks the mill will be operated to capacity. The advent of \$50 ore prices has already resulted in a general resumption of operations at a number of mines, and the mines that have been running with a minimum capacity are asking for more laborers preparatory to increasing their output. Among the mines resuming operation to capacity are the Mattes Bros., Hartford, Oronogo Circle, White Dog, Continental, Comanche, Bertha A., Wingfield, Mercantile and C. & S. mines. From these will come a considerable addition to the weekly output. The entire Miami camp will be speeded up and a very much larger output will be obtained.

O. W. Sparks Has Completed Drilling on a lease just east of his Yellow Pup property, and out of seven holes, five proved good ones. A shaft that had been sunk to 135 ft. near one of the best holes will be used and drifting started from the 120-ft. level to catch the ore deposit discovered at that depth in the drill holes. If the drifting shows as good ore as the drilling indicated, a mill will be started at once. The Calumet Mining Co., on a lease of 20 acres southeast of Joplin, has developed a property upon which a mill will be erected immediately. After sinking 17 drill holes in an effort to thoroughly test the ground, two shafts have been put down and drifting sufficient to open up the ground completed. The ore is in soft timbering ground at the 120-ft. level.

DAWSON, Y. T.—July 15

The Season's Gold Yield is now being estimated at \$4,000,000 to \$6,000,000. Over \$250,000 in gold was sent out as an initial shipment a few days ago. Practically all the mining is being done by dredging, and in no place has this system been so highly perfected as in the Dawson camp. Twelve of the largest dredges in operation are now at work within sight of the city. While many of the big operators are giving their entire attention to dredge work, Treadgold, the premier Yukon mining organizer, is being watched with great interest by miners in all sections of Alaska. He has already met with considerable success in the use of the steam shovel. The shovels are lighter and less costly than the large dredges, and on account of their size they can work many of the streams that are too small to warrant operation by dredges. His tryouts mean much to the miner of small means. There is no way for the small operator to work ground which is commonly called dredge ground on account of the depth at which gold is found on the bedrock and only workable so far with a dredge. If steam-shovel work is perfected so that the small miner can operate them profitably, his field of operations will be greatly enlarged. The quartz prospects near Dawson are as promising or more so now than ever.

The Mining News

ARIZONA

Yuma County

EMPIRE MINE (Parker)—Will resume work in about 30 days. Mine has been closed since February, 1913, on account litigation. Will employ about 50 miners. On Carnation claim a small mountain is said to assay about \$20 copper and gold on surface.

Santa Cruz County

OLD RED MOUNTAIN (Patagonia)—Johnson & Hanson struck good body lead-silver ore at 700-ft. station in tunnel on Elevation claim.

CONNECTICUT—This group in the Josephine Cañon in the Santa Ritas has been bonded to Tate, Hudson & Gartley, of Bisbee, by R. R. Richardson, and they are taking out silver ore at present, leaving the copper ore to more settled times. This property has sent out a good deal of ore.

COBRE—Group, two miles north of Alto, now being worked by Brown & Co. under lease from Josiah Bond. Ore is copper-lead-silver, netting about \$30. El Paso offering to make advances on ore shipped and balance after market is again opened with regular quotations, but is discouraging shipments for present.

BRADFORD—A. L. Harroun, of Lucky Tiger fame, has formed the Sonoita Copper Co. to work this old mine, recently bought by him from the Ferry estate. The mine has formerly sent out some good ore. It is two miles from Bloxton station, on the Nogales-Benson R.R.

GLOVE—This group has been bonded by Sheehy Brothers to a syndicate organized by Thomas Park, recently of the Elephant's Head mine. About 30 men are at work on the group, sinking on good lead-zinc showings along a limestone contact.

JOPLIN—It is understood that the Joplin Mining Co. will give a lease on its group to Chris Rasmussen, who has been working on the Three Stars mine, extracting silver-lead ore. The Joplin was a shipper some years ago, but has been idle since then.

LEE—This mine, in Mansfield Cañon, east of Alto, reports good copper ore at the 450-ft. level, which can be shipped at about 8% copper, and the silver contents besides. It cannot be handled on the present lack of market, and is being piled on the dump for future use; there is some talk of a mill to utilize a large amount of lower grade siliceous ore. A new compressor has been installed and is giving satisfaction. The season has been dry, and this property as well as others is suffering. It has been the hottest August ever experienced in this county.

SHIPPERS—Work has been suspended on several properties owing to war conditions prevailing. Among them are reported the Royal Blue, World's Fair and the R. R. R. The latter is the largest shipper in the county; many small operators are put out of commission also for the same reason. Some ore is being piled up at Patagonia, though it cannot be shipped to advantage now.

Yuma County

KING OF ARIZONA (Yuma)—Operations are again under way at King of Arizona. Felix Mayhew has thirty men at work. Mill has been rehabilitated.

CALIFORNIA

Amador County

PLYMOUTH CONSOLIDATED (Plymouth)—Mine and mill in steady operation. Though property is operated by Bewick, Moreing & Co., of London, operation will not be disturbed by financial situation in Europe, as property has passed the development stage and is now a producer. Town of Plymouth is making improvements made possible by the reopening of the mine.

SOUTH EUREKA (Sutter Creek)—Sixty stamps dropping on good ore and quantity of ore blocked out reported sufficient to guarantee long uninterrupted run. Recent repairs placed shaft in good condition.

HARDENBERG (Jackson)—Operation reduced, but mine and mill kept in shape for early resumption of regular work.

FIVE-TON POPE HARTFORD auto truck purchased by S. Thompson, of Jackson, to be employed hauling lagging and other timbers to Argonaut and other mines. Initial trip made with 1200 pieces lagging.

Butte County

CLAY DEPOSITS five miles north of Oroville, recently exploited by L. A. Jenks, to be developed by local company. If development warrants, a plant will be installed and a spur track built by the Northern Electric.

Calaveras County

ROYAL CONSOLIDATED (San Andreas)—Property recently examined and reopening contemplated. Large amount of low-grade ore reported.

THORPE (Fourth Crossing)—Reported that mine will be reopened. Men now employed preparing for development. Formerly a producer.

Eldorado County

CRUSADER (Eldorado)—Good ore reported on 100-ft. level and crosscutting in progress. Mine recently bonded to Lloyd Tevis and P. D. Burt, of San Francisco.

LIMESTONE DEPOSITS near Shingle Springs are being developed by Bonnefoy Bros., of Placerville. Kiln and aerial tram installation is contemplated. Shipment of rock to

Berkeley via Southern Pacific at Bullard station already in progress.

SOAPSTONE DEPOSIT near Latrobe being developed by Charles Swift. Preparations being made for shipping product.

MOUNTAIN QUARRIES CO. (Flint)—One thousand tons of rock per day being shipped over Mountain Quarries R.R. to Auburn, thence by Southern Pacific to Cement, Soiano County, used in manufacture of portland cement; 135 men employed at quarries.

RISING HOPE (Placerville)—Number of miners increased for extensive development.

Inyo County

CERRO GORDO MINING CO. (Keeler)—Articles of incorporation filed with county clerk. Principal place of business, Phoenix, Ariz. Directors are A. L. Dornberger, F. J. Hambly, John E. Richards, of San José; F. J. Hagenbarth, of Salt Lake; Louis D. Gordon, of Keeler.

CASA DIABLO—Repair of pipe line completed. Rebuilding cyanide plant begun. Several thousand tons of low-grade tailings will be treated.

CLOUDBURST IN CERRO GORDO CAÑON, Aug. 8, washed out the road to Cerro Gordo mine, carried two drums of gasoline through the cañon, damaged streets in mining camp. Before reaching Keeler, water divided into three streams, preventing damage to Keeler property.

WILSHIRE BISHOP CREEK (Bishop)—Sawing lumber and other work necessary to installation of cyanide plant in progress, but underground work discontinued temporarily.

Kern County

BIG BLUE (Kernville)—William G. Long, superintendent; Crayton Long and William Wharton, Stanford students visiting the mine, died from suffocation while fighting fire in the mine Aug. 12. The body of W. G. Long was recovered by citizens of Kernville, but the other bodies could not be reached at the time on account of smoke and fume. Experienced firemen were then called from Bakersfield, 65 miles southwest.

GOLDEN (Caliente)—New mill is under construction. Large amount of ore blocked out.

San Bernardino County

ATOLIA (Atolia)—Leasers at the tungsten mines have been notified that their leases will expire Aug. 30. The cleanups by the leasers in July aggregated about \$12,000.

Shasta County

MOUNTAIN COPPER CO. (Redding)—Iron Mountain mine, which in 18 years had produced ore valued at \$27,000,000, was closed Aug. 6; 350 men were laid off and company's output reduced 80%. Smelter at Martinez will also be closed.

COLORADO

Lake County

LEADVILLE—Uncertain silver market and depression in lead and zinc prices have made uncertain continuance of operations in majority of Leadville's mines. So far as possible, work being kept up. The gold mines will continue at normal production, and if the Mint authorities maintain the purchase of a million ounces of silver per week, according to present hopes, most silver mines will continue. Zinc-smelting plant of the Western Mining & Reducing Co. closed indefinitely. Managers of several large mining companies, such as Western, Iron-Silver, Col. Sellers, New Monarch and Yak, assert that they are running as usual. At many mines, during this enforced suspension, it is planned to make surface improvements and extend development.

Ouray County

WANAKAH SMELTERY (Ouray)—This department of the Wahakah Mines Co. is undergoing alterations and improvements to reduce costs in handling ore and products. New capacity is to be 200 tons and plant is expected ready for service in October. Manager John T. Roberts, Jr., is considering erection of sintering furnace for flue dust.

San Juan County

OCCIDENTAL (Silverton)—H. G. Green has installed compressor plant to drive ahead in main adit.

WILFLEY-MEARS MILL (Silverton)—New plant to recover concentrate from old dump at Silver Lake mine, on a special type of Wilfley table, is started up. Material is flushed from the edge of the lake, over a cliff, and into wooden flume that conveys to the mill, two miles distant.

Clear Creek County

MINT (Empire)—Milling ore is being opened by development work now in progress. The mill is being enlarged and new equipment will be added. Jigs, Wilfley tables and a canvas sliming table are being installed.

MINNESOTA

Cuyuna Range

HAWKINS (Nashwauk)—Work was to be resumed Aug. 10 with two shovels in ore and one in the overburden; 100 men are employed and daily output is 100 cars.

MICHIGAN**Marquette County**

AMERICAN (Diorite)—This property has been closed down for repairs. Shaft will be lined with steel and concrete from top to bottom, which will greatly improve outlet, which has been giving some trouble of late. Company has been shipping steadily for some time to Algoma Steel Co. at Canadian Soo.

TAXATION OF MINERAL RESERVATIONS—County board of equalization of Crow Wing County, in which county bulk of Cuyuna range is, at its annual meeting decided on a valuation of \$2 per acre, regardless of location of such reservations in county. Recent decisions of state supreme court have held such action to be lawful. Heretofore all assessments have been levied against surface rights only, and as mineral rights are frequently held separately, owners of such rights have been tax free. Weyerhaeuser and Northern Pacific Ry. interests will be most affected, as their lands have for some years been sold with mineral reservation.

MONTANA**Broadwater County**

COMBINATION-KEATING MINING CO. VS. ROBERT L. CLINTON AND H. GYSBERT KLENZE—Suit was instituted by this company against defendants to quiet title to four mining claims and for accounting of sale to the Cactus Mining Co. through Mr. Clinton. Plaintiffs claim title to Combination-Keating and Helena claims, situated in Cedar Plains district, and allege that, while acting as company's manager, Mr. Klenze located Combination and the Minneapolis claims in his own name, whereas he was holding them in trust for company. Subsequently, all four claims were sold to the Cactus company, which made payment of \$2652, and then failed to pay balance of \$40,950. Through vendors' lien company again secured title to property and judgment for \$41,597. Plaintiffs ask for sheriff's sale of property, sheriff's deed with a clear title and accounting of the transaction.

Deer Lodge County

WASHOE WORKS (Anaconda)—General Manager E. P. Mathewson made announcement to the effect that during the curtailment of work, married men would be given preference in the operating department.

Madison County

WYROUCK MINE (Bear Gulch)—With new crusher in place, cyanide plant will hereafter be able to treat 50 tons per day and make net profit from \$4 to \$6 a ton. Crusher has maximum capacity of 480 tons in 24 hrs., which will permit increasing capacity of plant by installing additional tanks. This, Manager A. R. Jones announces, will be done in near future, as property and orebodies fully warrant expenditure.

Park County

COOK CITY MINING DISTRICT—With prospect that the smelting plant at Cook City will soon be ready for treating gold, silver, lead and copper ores from mines in district, activity in the camp has materially increased. Many of the old mines are being developed by original owners and outside interests. It is general belief that with smelters in operation, the transportation problem which has been the stumbling block for profitable operation in the past will be overcome.

Powell County

ELLISTON COPPER MINING CO. (Elliston)—A creditors' petition in bankruptcy was filed in federal court Aug. 17, in which company is alleged to be bankrupt. Petitioners aver that company committed act of bankruptcy by permitting William Rawlings, a creditor, to attach property for a debt of \$1982. Company is operating a group of claims near Elliston. Amount due to creditors who filed petition is \$743.

Silver Bow County

ANACONDA COPPER MINING CO. (Butte)—During present curtailment of output, which caused the closing of seven of the company's mines, the following working schedule has been adopted for the mines which remain active: Leonard, Tramway, East and West Colusa and Berkeley will be closed down on Sundays and Mondays; the Anaconda, St. Lawrence, Original, Stewart, West Gray Rock and J. I. C. will close down on Saturdays and Sundays. By this arrangement, all the mines will be closed on Sundays, but there will be mines working every other day, thus keeping the ore supply for the Washoe smelter more uniform.

BULLWHACKER COPPER CO. (Butte)—Judgment against company and in favor of Clark Bros. & Klein, of Spokane, Wash., for \$123,426, money advanced and \$1000 attorney fee, ordered entered Aug. 10, in Judge McClernan's court, company confessing the indebtedness on the promissory notes. This puts Clark interests practically in control of company's property.

BUTTE MINE WORKERS' UNION (Butte)—At the first annual election of new union, held Aug. 10, Muckie McDonald, who led revolt of miners against Western Federation, and who had been temporary president of new union, was elected president. There were also elected a vice-president, secretary, treasurer and five directors for the executive board.

NEVADA**Churchill County**

CANON POWER CO. (Lahonton)—Company has been awarded power rights at Lahontan dam, by reclamation service, for period 10 years.

Elko County

RAILROAD SURVEY TO BULLION from Raine's Siding on Eureka & Palisade R.R. is being made.

HOME MINING & REDUCTION CO. (Bullion)—This company now operating Elk lease. Other properties shipping from this district are Sweepstakes and Sylvania; five cars per week are shipped.

EASTERN STAR MINING CO. (Gold Circle)—A 50-ton mill will be built, it is stated. Shipment will be made to California Ore Testing Co., of San Francisco, to determine

best process. Mine has been opened to 240 ft. and large tonnage of milling-grade ore and some shipping-grade ore developed.

Esmeralda County

BOOTH (Goldfield)—Sinking winze below 500-ft. level has been resumed; winze is 145 ft. deep and will be sunk to 700-ft. level. Pump with capacity of 50 gal. per min. is installed and used in sinking.

BLACK BUTTE (Goldfield)—Development work has been done on tunnel 50- and 100-ft. levels. Shoot of good grade ore has been opened on 100-ft. level and further work will be done.

GOLDFIELD ORO (Goldfield)—Satisfactory progress is being made on 700-ft. level in development work; 810-ft. level is being retimbered preparatory to further development work.

SILVER PICK (Goldfield)—Force greatly reduced on account unsettled financial conditions.

Eureka County

UNION MINING CO. (Palisade)—A 50-ton concentrating plant will be built, it is stated, at this silver-lead property, 35 miles south of Palisade; plant to have crushers, rolls, jigs and vanners. Shipments have been made until recently; this has been stopped and development work only done until mill is completed.

Humboldt County

PACKARD (Rochester)—This lease will not close, it is stated. Large tonnage of good grade silver ore is being developed. When new short line is finished, shipments will be increased.

FLUNKEY (Rochester)—Blacksmith shop and storehouse have been built and tunnel will be driven below upper workings.

BUCK & CHARLIE (Rochester)—Good grade lead-silver oreshoot has been struck in lower tunnel.

BLOWBACK (Rochester)—High-grade ore is being mined from this claim on Lincoln Hill. Recent shipment, it is stated, assayed \$250 per ton, nearly all gold.

KENNEDY (Kennedy)—Option on three claims, Virginia, Hazel Bell and Ida, of Kennedy property has been secured. Tests on ore being made to determine necessary changes in Jenkin mill, which has been purchased. Large tonnage of milling-grade ore has been developed in this district, especially in Virginia mine.

Lincoln County

AMALGAMATED POCHE (Pocche)—Work at No. 1 shaft is progressing satisfactory. Driving west drift on 14th level has been stopped until water is pumped out of Black Ledge winze, then connection will be made. Flow of water is large, and was formerly pumped to 12th level, from where it flowed off through old Raymond & Ely mine; will now be pumped to surface. Good-grade oreshoot has been opened on 14th level. Shipment of lead-zinc ore was made from 12th level recently.

Lyon County

CONSTANTINE (Yerington)—A 6-ft. shoot high-grade copper ore struck at 182 ft. in shaft. Shaft will be sunk to 200-ft. level and drifting will then be done.

WHEELER (Yerington)—Two leases have recently been let at this property on Mount Grant, one in mine, from which shipping-grade ore is being taken; and other on old mill tailings, which will be re-treated by concentration.

Mineral County

SILVER STATE—Small mill at this mine in Lappan Cañon is being run. Development work is progressing satisfactorily.

Nye County

COMMERCIAL MINES CO. (Manhattan)—Negotiations with Jumping Jack Merger Mines Co. for lease or option under way. War Eagle mill purchased recently and increased from 10 to 20 stamps. Company will increase holdings in district.

WEST END CONSOLIDATED (Tonopah)—New oreshoots on fourth and fifth levels opened. July mill cleanup stored in Tonopah, pending reopening of silver market.

CLOUDBURST AT MANHATTAN, on Aug. 7, did much damage to placer mines in west end of town, and damage to upper end of town is estimated to be \$2000.

GOLDEN ARROW DEVELOPMENT CO. (Golden Arrow)—Grading for new 10-stamp mill commenced. Process includes Huntington mills and cyanide. Electric power used. Compressor pumps and machine drills will be installed.

TONOPAH MINING CO. (Tonopah)—Considerable new development under way in Silver Top and Red Plume sections of property.

MacNAMARA (Tonopah)—Operations temporarily suspended in mine and mill, account market price of silver.

NEVADA CINNABAR CO. (Ione)—Shipment of 400 flasks of quicksilver will soon be made.

Storey County

COMSTOCK PUMPING ASSOCIATION (Virginia City)—Ventilation improvements being made on 1600-ft. level; second concrete bulkhead will be built in north lateral of Sutro tunnel. Pumps operating satisfactorily and water held at usual level.

UNION CONSOLIDATED (Virginia City)—West crosscut started from 2650-ft. station of winze. New level will be opened.

MEXICAN (Virginia City)—Hoist is being installed at winze that will be pumped out, and sump will be sunk below 2650-ft. level before station is cut. Development in south drift in Union-Mexican crosscut on 2500-ft. level is progressing satisfactorily.

COMSTOCK - PHOENIX (Virginia City)—Development work is being done on 650-ft. level.

BUTTERS MILL (Virginia City)—This mill, in Six Mile cañon, is under lease to Charles Duval, who is treating ore from Chollar croppings.

White Pine County

ELY CALUMET (Ely)—Sinking in Gladys shaft resumed. Shaft is 300 ft. deep and will be sunk to water level.

CONSOLIDATED COPPER MINES CO. (Ely)—It is stated that 21,624,000 tons of 1.153% copper ore are developed and additional tonnages being added as development progresses. It has been decided that 40,000,000 tons is minimum upon which to base construction of mill. Large tonnage of ore mined on Giroux ground by a Nevada Consolidated steam shovel that is opening a road to Liberty Pit.

NEW MEXICO

Grant County

PHELPS, DODGE & CO. (Fierro)—Development work on Emma and other mines stopped. Pumps being pulled. Properties not producers.

CHINO COPPER CO. (Hurley)—Steel structural work for new addition to power plant being raised.

SILVER CELL MINE (Pinos Altos)—Mine equipment being put in workable order. Development work on vein recently encountered shows good grade silver ore. One 50-lb. nugget was taken out recently averaging about 75% silver. Gudger & McSherry, of Silver City, are operating mine.

GOLDEN GIANT MINING & MILLING CO. (Pinos Altos)—Mill and mine will be reopened under management of R. H. Perry and Robert Michel.

EIGHTY-FIVE MINING CO. (Lordsburg)—Company temporarily discontinued operations with other copper mines in Southwest, due to demoralization of copper market.

Santa Fé County

SANTA FE COPPER CO. (San Pedro)—Company employing 40 men on development work. Reported company struck large body of good copper ore, chalcopryrite with garnet and quartz gangue.

Taos County

HAMM MINING & MILLING CO. (South Forks)—At trustee's sale, Aug. 1, Edwin Singleton, of Dallas, was successful bidder. Sale included valuable mill. Property is in Rio Hondo mining district.

Socorro County

MINING COMPANIES IN MOGOLLON DISTRICT are curtailing production owing to stringent money market. However, all continue to operate, none affecting complete close-down. Road conditions improved owing to end of rainy season. Plans under way to build new road from Gila over Sacaton flat if cooperation of Silver City business men can be secured. Three new auto trucks added to Mogollon transportation service.

BURRO MOUNTAIN COPPER CO. (Tyrone)—Forces have been slightly increased. Power-plant construction work continues.

C. F. & I. CO. (Fierro)—Company continues daily shipments from ore from Bessemer and Brockman properties to Pueblo, Col., smelter. Only large company in section now operating.

GILCHRIST & DAWSON (Fierro)—Fifty-three sacks high-grade gold ore on dumps. J. B. Gilchrist working 18-in. vein recently discovered in Fierro basin.

SOUTH DAKOTA

Lawrence County

DEADWOOD-STANDARD (Ragged Top)—Cyanide plant being operated by lessees, Hodges and associates, of Terry, at partial capacity. Recently oreshoot discovered which gives promise of developing into considerable importance; if so, mill roof will be repaired and other work done to enable plant to work full capacity during coming winter.

KALEVA (Roubaix)—Company recently reorganized by Lead parties, who plan to erect small mill.

TROJAN (Trojan)—Mike Stabbio, a miner, was killed by fall of roof in stope, which, according to Supt. H. Slaughter, employees had been warned not to enter until it had been timbered. Timbering had been ordered, but had not started.

WASP NO. 2 (Flatiron)—Regular monthly dividend of 1c. per share was declared on 15th. Property running at full capacity, but grade of ore below normal for past 60 days.

HEIDELBERG (Two Bit)—Shaft has been started in main adit, using windlass. Raise to surface, about 100 ft., will be made directly over shaft and connection thus made with machinery which will be housed on surface. South Dakota "blue-sky" commission recently gave company permission to sell treasury stock.

NO SHORTAGE OF CYANIDE IS ANTICIPATED in Black Hills, notwithstanding reports of sensational nature which have been circulated. Kirk G. Phillips Estate, sole South Dakota agents for Roessler & Hasslacher Co., have nearly a full carload on hand, sufficient for two months' operations of all plants aside from Homestake, and have promise of another carload in 60 days. Homestake is not experiencing any difficulty in securing a supply.

GOLDEN REWARD (Deadwood)—Reports at annual meeting of company say operations have been more profitable during past two years, under system adopted of leasing the various properties, than they were previous to that time. At present time, more than half of mill supply comes from lessees on company's property; shipments of smelting grade are also regularly going forward.

BISMARCK (Flatiron)—Everything about plant running smoothly; mill handling 200 tons daily.

RATTLESLAKE JACK (Galena)—Mill construction partially curtailed; certain changes of plans are under consideration. Work in mine proceeding rapidly.

HOMESTAKE (Lead)—Recreation Hall practically completed, and will be open in a few days to the public in all departments. Bowling alleys opened recently, and on Aug. 31 the first performance will be given in the theatre. It is announced that the schedule of prices will be \$1 to 25c. for shows, and a tax of 5c. a head for the "movies," which will afford entertainment on nights when the stage is not otherwise occupied.

GEMINI (Eureka)—Operation of lessees will not be curtailed in any manner, according to General Manager McChrystal. Management will continue to make settlements with the smelters as it has in the past. Provisional settlements have recently been made on 1000 tons of lead-silver ore. About 100 lessees working at present.

UTAH

Summit County

PARK CITY SHIPMENTS of ore and concentrates during July amounted to 6041 tons; for week ended Aug. 14 shipments amounted to 1083 tons; those for preceding week were 1276 tons.

SILVER KING COALITION (Park City)—Work on 100-ft. level of Silver King shaft has opened shipping ore. Company operating mine and mill about as usual. There are 400 men on the payroll.

DALY-JUDGE (Park City)—Working forces have been reduced, as property is not in position to mine and store ores, and under present conditions it is not known exactly whether operations would be at profit or loss on account final adjustment or settlement in price of silver. First-class shipping and milling ores are mined together, and storage of mill ores would be impracticable. Work on Snake Creek tunnel will not be slackened, and daily progress of 14 ft. being made. The face is in 8600 ft. It is understood some experimental work will be done at the mill and main shaft will be repaired.

DALY-JUDGE (Park City)—Good ore opened in Daly vein at higher levels than heretofore. Drifting being done on 300 level to reach this ore.

THOMPSON-QUINCY (Park City)—Work suspended on account unsettled condition of metal market.

DALY-WEST (Park City)—Equipment for new mill and hoist is arriving and being installed. The mill will be slightly below the old site. Foundations are in. Electric power used entirely. Lessees on the upper levels working and sending out ore through the 1200-ft. level tunnel.

MINES OPERATING (Park City)—Shipment of 18 bars silver bullion made recently to the National Copper Bank, Salt Lake City. This represented mill run for the latter half July and amounted to 16,000 oz. The total output for the month was about 33,000 oz. Ore from which this was produced was mined from the Ontario tunnel level and above, from a block of ground under lease to this company. It carried 9 or 10 oz. of silver per ton. Mill has been making extraction of 80% or better, and when new Holt-Dern furnaces are installed a larger recovery will be made and operating expenses reduced. Final papers in the patents for the processes employed by this company were received in Salt Lake Aug. 18. The company employs 100 men in mine and mill.

SILVER KING CONSOLIDATED (Park City)—This company is shipping 25 to 30 tons first-class ore daily, coming from development. During July, 1045 tons were shipped. Much new ore being developed, and it has been necessary to continue shipments on account of lack of storage facilities. The Utah Light & Power Co. is extending a line to this property, and electric power will be used.

Salt Lake County

UTAH APEX (Bingham)—New mill, which was designed for 350 tons a day, has been treating up to 425 tons, and is doing excellent work. Problem of tailings disposal has been solved by the purchase of land jointly with the Bingham-New Haven Co., which will accommodate tailings for a number of years. Earnings have been fairly good in spite of low price of lead.

BINGHAM MINES (Bingham)—Leases recently been granted on some old workings, including the Dalton & Lark mine, to men who have recently lost employment through curtailment at other properties.

CANADA

Ontario

CITY OF COBALT (Cobalt)—Shareholders have approved resolution providing for voluntary winding up of company. Mine becomes property of Mining Corporation of Canada, and shareholders will receive shares in the new company for present holdings.

NIPISSING (Cobalt)—During July, this company mined ore of estimated net value of \$211,596, and shipped bullion from Nipissing and customs ore of a net value of \$231,858.

McINTYRE (Schumacher)—Negotiations are under way for the purchase of control of this property by the Nipissing.

DOMES (Porcupine)—During July, treated 19,780 tons and recovered \$82,984 in bullion. The mill ran 91% of the possible running time.

FOLEY-O'BRIEN (Porcupine)—Power house was burned in bush fires which menaced Porcupine.

BELL ASBESTOS MINES (Quebec)—These mines have been closed owing to inability to ship asbestos to London.

TOUGH-OAKES (Swastika)—Underground work has been stopped on account of failure of electric power plant at Charlton. It may be two months before underground work is resumed. Excavations for new mill have been started.

MICHAELSON ORE REDUCTION WORKS (Sault Ste Marie)—Mill and concentrating plant is being rearranged to embody a greater variety of operations and is expected to be in working order by Sept. 1, 1914.

The Market Report

METAL MARKETS

NEW YORK—Aug. 26

The metal markets are still disorganized owing to conditions abroad. Spelter continues extraordinarily strong and active. There have been great advances in several of the minor metals.

Copper, Tin, Lead and Zinc

Copper—The situation remains unchanged. Consumers are supplied with what they want but producers make no effort to sell. Copper continues to be exported under old contracts.

Base price of sheet copper was reduced ½c. on Aug. 13, and is now 18c. per lb. for hot rolled and 19c. for cold rolled. The usual extras are charged, and higher prices for small quantities. The price for tinning sheets has been advanced to 3½c. per sq.ft. on account of the high price of tin.

Exports of copper from New York for the week were 5804 long tons. Our special correspondent gives the exports from Baltimore for the week at 327 tons.

Tin—Supplies are becoming a little more plentiful, as is indicated by the disappearance of the fancy prices of a few days ago, but the business is still chiefly in one- to five-ton lots, and there is not yet a broad, wholesale market.

Lead—A rather large business has been done and the tone of the market is firmer. However, the desire to liquidate holdings has prevented any material advance in price as yet. If the export movement obtains more headway, a further improvement in the market may result. During the last week a considerable tonnage of lead for export was reported sold. This is going out through numerous ports, wherever space may be secured. Some lead has gone out through Montreal. The muddle over foreign exchange and the troubles of cable communication render the export business more or less difficult.

Exports from Baltimore for the week included 112,087 lb. lead to Liverpool.

Spelter—This market has been curious in that while there has been a crazy demand from abroad there has been scarcely any from domestic quarters, and while producers have obtained high prices for export, they have been willing to sell at home for less money. Speculative operations seem to have been playing a considerable part. On certain days of the week, sales have been reported at wide ranges and it is difficult to quote the average of the market. On Aug. 24 there were sales from 5.80 to 6c. On Aug. 25, one lot fetched 6.10c., St. Louis, with more wanted at the same price, but on the same day sales were made at 5.85c. Brass specials and intermediate grades of spelter have realized all kinds of fancy prices, ranging upward from 6c. The aggregate of the sales for export is again large. At the close the market seems to be halting, some producers figuring that England has overbought its near-by requirements. Others, however, take a different view. It is certain that between their large sales at low prices previous to July 31 and their subsequent sales for export producers have greatly relieved themselves of the load they were carrying.

All quotations on zinc sheets were withdrawn on Aug. 20 by the makers, on account of the existing conditions in the zinc ore and spelter market. Sales are made on private terms.

Other Metals

Aluminum—The market continues quiet and there is not much business doing. Imports are stopped for the time and domestic shipments are chiefly on contract. Quotations are rather nominal at 20@20½c. per lb. for No. 1 ingots.

Antimony—A fair business is being done and prices are a little easier, but still rather nominal. Ordinary brands are 14@15.50c. per lb. For Cookson's 17@18c. per lb. is asked, and 16@16.50c. for other special brands.

Quicksilver—The market here continues very strong, the metal being held at \$90@100 per flask of 75 lb., New York. All business in London is stopped and exports are prohibited.

Gold, Silver and Platinum

Silver—Messrs. Handy & Harman make the following statement on Aug. 26, regarding the silver-market situation: During the past week the spot quotation for silver in London was established as follows: Aug. 19, 26½d.; 20, 26d.; 21, 26d.; 22, 25½d.; 24, 25½d.; 25, 24½d.; 26, 25d. These were prices at which spot silver or silver for immediate delivery in London could be sold on the days mentioned.

Owing to delays in cables and uncertainty in the matter of shipment on account of war risks and the sale of foreign exchange, no New York official quotation, however, was made until Aug. 22, when the New York official price was established at 56c., based on the London price of Aug. 21, of 26d., at which large sales were made. On Aug. 24, the New York official price was quoted at 55½c., based on the London quotation of Aug. 22, of 25½d. On Aug. 25, however, owing to the more prompt deliveries of cables, the New York official price was established at 53½c., based on the London quotation of the same date of 24½d., and today at 54½c., based on London quotation of 25d. of same date.

As the general situation has cleared up somewhat and shipments of silver in large quantities to London are being made and sales of silver have been effected in London at the official quotation, it was deemed advisable by various interests, to issue a New York official price based on actual transactions in London, after taking into consideration the extra expense of shipments, owing to war risks for freight and insurance.

The London market for silver is very sensitive and uncertain and is subject to wide fluctuations, owing to financial conditions. At present the demand for silver in London for export to the Far East is nil, owing to the risks of shipment and also the high price for silver, at which price the Eastern Exchanges do not warrant purchases of silver for the present. The present demand for silver in London is for coinage purposes and already the English Mint has bought largely and there have also been executed large orders for Continental demands. It is likely that such a demand from various countries will continue, but these orders are very uncertain, and with the large arrival of silver by American shipments and silver being pressed for sale, the price has been forced down. It is probable that there will be consid-

DAILY PRICES OF METALS

NEW YORK									
Aug.	Sterling Exchange	Silver, Cts. per Oz.	Copper Electrolytic, Cts. per Lb.	Tin Cts. per Lb.	Lead		Zinc		St. Louis Cts. per Lb.
					New York, Cts. per Lb.	St. Louis Cts. per Lb.	New York, Cts. per Lb.	St. Louis Cts. per Lb.	
					3.87½	3.70	5.85	5.70	
20	*	*	*	†46	@3.90	@3.75	@5.90	@5.75	
21	*	*	*	†42	3.90	@3.70	5.85	5.70	
22	*	56	*	†42	3.90	@3.75	@5.95	@5.80	
24	*	55½	*	†40	3.90	@3.70	5.85	5.70	
25	*	53½	*	†39	3.90	@3.75	@5.95	@5.80	
26	*	54½	*	†39	3.90	@3.70	@6.15	@6.00	
						@3.75	@6.00	@5.85	
						@3.70	@6.25	@6.10	
						@3.75	@6.00	@5.85	
						@3.70	@6.25	@6.10	

*No quotations. †Nominal.

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.

Some current freight rates on metals per 100 lb., are: St. Louis-New York, 15½c.; St. Louis-Chicago, 6c.; St. Louis-Pittsburgh, 12½c.; Chicago-Baltimore, 10½c.; Chicago-New York, 13½c.

erable curtailment in the production of silver, owing to the closing down of certain copper-silver bearing mines, and also owing to the difficulty of obtaining certain material necessary for smelting and refining operations.

During the last week refiners have been shipping silver to Europe in large quantity in American ships and have been selling almost entirely to the foreign mints. These shipments apparently overstocked the London market, wherefore the sharp decline on Tuesday. As yet there is no Indian demand. The first shipments to Europe were on consignment. Later the London market opened to the extent of dealings in the ordinary contracts for prompt, or two-weeks' deliveries, but there are not yet any dealings in futures. The wild fluctuations in exchange render the international business very much of a gamble. Handy & Harman are computing the New York official price on the basis of exchange at 4.90.

Shipments of silver from London to the East, Jan. 1 to Aug. 13, as reported by Messrs. Pixley & Abell:

	1913	1914	Changes
India	£4,393,500	£4,454,500	I. £61,000
China	507,000	42,000	D. 465,000
Total	£4,900,500	£4,496,500	D. £404,000

The stocks in London when shipments were interrupted by war were close to 5,000,000 oz., but are now considerably reduced.

Platinum—So far as the foreign market is concerned, there is no change, and no quotations are available. The prices here have been advanced to cover war risks, insurance and uncertainty of supplies. Dealers are quoting prices only for immediate delivery, at \$50 per oz. for refined platinum, and \$57.50 for hard metal, 15% iridium.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Aug. 22

The base price paid this week for 60% zinc ore was \$45@46 per ton. The base price paid for 80% lead ore was \$46 per ton.

SHIPMENTS WEEK ENDED AUG. 22

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	3,236,200	.....	169,600
Year	98,698,050	3,520,500	23,844,570

Shipped during week to separating plants, 2,982,390 lb. zinc ore.

JOPLIN, MO.—Aug. 22

The high price of blende advanced to \$51, and the assay base ranges \$45@49.50, with the metal base \$44@46 per ton of 60% zinc. Calamine sold \$23.50@25 per ton of 40% zinc. The average selling price of all grades of zinc is \$43.48, an increase of \$4.58 per ton over the previous week. Sellers are generally controlling the market, withholding ore from sale until a suitable advance is made. The high price of lead ore is \$47.75, and the base continues at \$46 per ton of 80% metal content. The average selling price of all grades of lead is \$45.80 per ton.

SHIPMENTS WEEK ENDED AUG. 22

	Blende	Calamine	Lead	Values
Total this week..	9,376,440	1,111,200	1,518,460	\$253,800
Total this year...	345,869,660	25,553,020	58,762,490	8,465,180

Blende value, the week, \$204,740; 34 weeks, \$6,675,220.
Calamine value, the week, \$14,285; 34 weeks, \$291,090.
Lead value, the week, \$34,775; 34 weeks, \$1,398,870.

IRON TRADE REVIEW

NEW YORK—Aug. 26

The iron and steel trades are still in uncertain condition. New orders are not plentiful, but specifications on contracts are coming in more freely.

The ferromanganese situation is easier, and supplies are not to be as restricted as was expected. Manganese ore from Brazil is expected to come here more freely, and it is probable that both spiegel and ferro of domestic make will be available before any actual scarcity is felt.

Export trade is likely to increase, English firms having already contracted for some tonnage of billets and sheet bars. They have been taking good quantities of this kind of material from Germany and Belgium, and those supplies are entirely cut off.

Imports at Baltimore for the week included 1350 tons ferromanganese from Middlesboro, England.

PITTSBURGH—Aug. 25

While the changes in the actual situation have not been strongly marked, there is a more optimistic feeling and the disposition generally is to look for improvement in the

trade. Inquiries for material are increasing, and many promise to develop into orders; while specifications on contracts are heavier. Buyers are still rather conservative, but are evidently feeling the effect of the improving financial conditions and the gradual settlement of uncertainties.

Fears of a shortage of ferromanganese are less prominent than they were, and it is now believed that surplus will be available, though prices will remain high.

There has been much talk of export trade, but the only inquiries actually received so far are for some quantities of steel billets. It is now believed that arrangements for shipment can be made without difficulty, though freight rates are likely to be high for some time to come.

The steel mills continue to run at about 70% of capacity, and some report even a higher rate. Operations seem likely to increase.

Pig Iron—The market remains extremely quiet, though with prices holding steadily. Shipments are at about the former rate, but all consumers are conservative. We continue to quote: Bessemer, \$14; basic, \$13; malleable, \$13@13.25; No. 2 foundry, \$13@13.25; forge, \$12.50@12.75, f.o.b. Valley furnaces, 90c. high delivered Pittsburgh.

Ferromanganese—There has been a few more resales at varying prices, and it is believed that the market has passed its high point, and that supplies will soon be available.

Steel—There is nothing new, and the market remains quotable at \$20 for billets and \$21 for sheet bars at mill, Pittsburgh or Youngstown.

COPPER SMELTERS' REPORT

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. 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.

	March	April	May	June	July
Alaska shipments.	2,069,960	1,279,537	585,387	1,114,758	2,879,396
Anacosta.....	23,800,000	22,900,000	23,500,000	23,800,000	.....
Arizona, Ltd.....	3,286,000	3,570,000	3,022,000	3,742,000	3,300,000
Copper Queen.....	7,637,042	7,562,723	8,388,203	7,613,719	7,817,318
Calumet & Ariz....	5,875,000	5,450,000	5,495,000	4,630,000	5,940,000
Chino.....	5,399,814	5,926,591	5,490,875	5,486,419	.....
Detroit.....	1,973,725	1,790,926	2,105,034	2,129,100	1,966,526
East Butte.....	1,546,180	1,178,000	1,179,762	1,215,323	.....
Giroux.....	287,980	45,948	429,553	425,000	.....
Mason Valley.....	1,250,000	862,000	916,000	950,000	.....
Mammoth.....	1,800,000	1,850,000	1,750,000	1,725,000	1,950,000
Nevada Con.....	5,218,257	4,880,043	4,959,589	4,483,175	.....
Ohio.....	597,520	610,518	625,000	605,000	.....
Old Dominion.....	2,997,000	2,779,000	3,302,000	2,937,000	2,962,000
Ray.....	6,036,908	6,089,362	6,300,847	5,941,567	.....
Shannon.....	1,082,000	1,012,000	1,056,000	1,049,227	.....
South Utah.....	406,381	247,641	55,394	84,000	.....
Tennessee.....	1,262,184	1,370,800	1,336,950	.....	.....
United Verde*.....	3,100,000	3,000,000	3,100,000	2,900,000	.....
Utah Copper Co.....	12,323,493	12,739,757	13,208,483	12,870,063	.....
Lake Superior*.....	11,000,000	13,000,000	12,500,000	16,000,000	.....
Non-rep. mines*..	8,200,000	8,000,000	8,000,000	8,000,000	.....
Scrap, etc.....	2,500,000	2,500,000	2,500,000	2,500,000	.....
Total prod.....	109,649,444	108,644,846	110,082,077	.....	.....
Imp., bars, etc.....	22,676,605	17,043,191	19,081,487	23,885,521	.....
Total blister....	132,326,049	125,688,037	129,163,564	.....	.....
Imp. ore & matte..	7,029,646	10,400,122	10,586,506	9,157,540	.....
Total Amer.....	139,355,695	136,088,159	139,750,070	.....	.....
Arrivals—Europe†	17,572,800	17,299,520	13,558,720	19,040,000	.....

† Does not include the arrivals from the United States.

Assessments

Company	Delinq.	Sale	Amt.
Alta, Nev.....	Aug. 18	Sept. 11	\$0.03
Aurora-Sampson, Ida. (post.).....	July 18	Sept. 18	0.002
Buffalo, Mont.....	Aug. 2	Sept. 2	0.004
C. & E., Ida.....	Aug. 18	Sept. 8	0.001
Cons. Imperial, Nev.....	Aug. 18	Sept. 10	0.01
Con. Virginia, Nev.....	Sept. 3	Sept. 24	0.10
Eagle Mountain, Ida.....	Aug. 22	Sept. 22	0.001
Emerald, Utah.....	Aug. 15	Sept. 12	0.0033
Exchequer, Nev.....	Aug. 13	Sept. 3	0.02
Huron, Mich. (Iron).....	.....	.....	3%
Hypotheek, Ida.....	Aug. 17	Sept. 15	0.01
Idaho & Los Angeles, Ida.....	Sept. 7	Sept. 25	0.005
Lacide, Ida.....	Aug. 21	Sept. 14	0.005
Lehi Tintic, Utah.....	Aug. 12	Sept. 17	0.0025
Lower Mammoth, Utah.....	Aug. 14	Sept. 7	0.01
Lucky Calumet, Ida.....	Aug. 21	Sept. 21	0.005
Maryland, Ida.....	Aug. 5	Sept. 5	0.003
Monarch-Pittsburgh, Nev.....	Aug. 17	Sept. 21	0.01
Mullan, Ida.....	Aug. 8	Sept. 8	0.002
New Hope, Ida. (post.).....	July 13	Sept. 11	0.002
North Star, Ida.....	Aug. 8	Sept. 10	0.0015
O. K., Utah.....	Aug. 17	Sept. 2	0.005
Ophir, Nev.....	Aug. 21	Sept. 14	0.10
Plutus, Utah.....	Aug. 28	Sept. 15	0.002
Providence, Utah.....	Aug. 3	Sept. 2	0.00125
Rockford, Ida.....	Aug. 14	Sept. 4	0.0015
Sandstorm-Kendall, Nev.....	Aug. 10	Sept. 14	0.01
Sierra Nevada, Nev.....	Aug. 18	Sept. 8	0.010
Tintic Standard, Utah.....	Aug. 10	Sept. 14	0.005
Torino, Ida.....	Aug. 10	Sept. 10	0.001
Tuscumbia.....	July 10	Sept. 8	0.003